

Service and Repair Manual

Coolant Heaters

DBW 2010

DBW 2020

DBW 300

Circulation Pumps

U4810

U4814

U4846

U4851



- Improper installation or repair of Webasto heating and cooling systems can cause fire or the leakage of deadly carbon monoxide leading to serious injury or death.
- Installation and repair of Webasto heating and cooling systems requires special Webasto training, technical information, special tools and special equipment.
- NEVER attempt to install or repair a Webasto heating or cooling system unless you have successfully completed the factory training course and have the technical skills, technical information, tools and equipment required to properly complete the necessary procedures.
- ALWAYS carefully follow Webasto installation and repair instructions and heed all WARNINGS.
- Webasto rejects any liability for problems and damage caused by the system being installed by untrained personnel.

Contents	Page
1. Introduction	7
1.1 Scope and Purpose	7
1.2 Applicability of Manual	7
1.3 Meaning of Warnings, Cautions and Notes	7
1.4 Additional Documentation to be used	7
1.5 Safety Information and Regulations	7
1.5.1 General Safety Notes	7
1.6 Legal Provisions for Installation	8
1.7 Corrections and Improvements	8
2. General Description	9
2.1 Parts of the Heater	12
2.1.1 Electronic Control Unit (1)	12
2.1.2 Overheat Fuse (15)	12
2.1.3 Temperature Limiter (17)	12
2.1.4 Temperature Control Thermostat (16)	12
2.1.5 Flame Detector (23)	13
2.1.6 Combustion Air Intake (26)	13
2.1.7 Combustion Air Fan (5) and Motor (2)	14
2.1.8 Coupling (4)	15
2.1.9 Toothed Gearing (6)	15
2.1.10 Fuel Pump (24)	15
2.1.11 Fuel Control Valve and Solenoid (8)	15
2.1.12 Fuel Nozzle and Nozzle Holder (14)	16
2.1.13 Fuel Line Connections (25)	16
2.1.14 Electronic Ignition Unit (3)	16
2.1.15 Ignition Electrodes (13)	16
2.1.16 Combustion Chamber (20), Combustion Air Swirler (21)	17
2.1.17 Heat Exchanger (19)	17
2.1.18 Preheat Thermostat (7)	17
2.1.19 Pre-heater Cartridge (10)	17
2.1.20 Coolant Circulating Pump	18
3. Functional Description	19
3.1 Switch ON	19
3.2 Heating Operation	19
3.3 Switch Off	19
4. Technical Data	20
4.1 Technical Data of the Heaters	21
4.2 Technical Data of the Circulating Pumps	22
4.3 Permissible Extension of the Connections	22
5. Troubleshooting	23
5.1 Quick Check Troubleshooting Matrix	23
5.2 Tester Instructions (Tester P/N 1302691A)	23
5.2.1 Test Procedures	23
5.3 Instructions for Fault Finding	26
5.3.1 Combustion Starts Immediately When Heater Is Switched ON	26
5.3.2 Heater Does Not Start When Switched ON	26
5.3.3 After Switching ON, The Heater Switches OFF after Approx. 30 Seconds On Fault	27
5.3.4 Heater Starts Only After Several Starting Attempts	28

5.3.5	Heater Switches Off By Itself During Operation	28
5.3.6	Heater Smokes	29
5.3.7	Heater Smokes	30
5.3.8	Heater Cannot Be Switched Off	30
6.	Functional Adjustments	31
6.1	General	31
6.2	Adjustments	31
6.2.1	Adjustment of CO2 Contents	31
6.2.2	Flame Detector Resistance Check	32
6.2.3	Ignition Electrode Check and Setting	32
6.2.4	Ignition Coil Check	33
6.2.5	Fuel Pump Check	33
6.2.6	Fuel Solenoid Valve Check	34
6.2.7	Nozzle Block Pre-heater Check	34
7.	Circuit Diagrams	35
7.1	DBW 2010 12 V and 24 V - Early Canadian Version	35
7.2	DBW 2010 12 V and 24 V - Present North American Version	36
7.3	DBW 2020 / 300 12 V and 24 V - without Nozzle Preheat	37
7.4	DBW 2020 / 300 12 V and 24 V - with Nozzle Preheat	38
7.5	Scholastic Heater 12 V - with On/Off Switch	39
7.6	Scholastic Heater 12 V - with 7-Day Timer Model 1529	40
7.7	Scholastic Heater 12 V - with 7-Day Timer Model 1531	41
7.8	Control Unit - Identification of Terminals	42
8.	Servicing	43
8.1	General	43
8.2	Heater Servicing	43
8.3	Vehicle Servicing	43
8.4	Heater Test Run	43
8.5	Maintenance	43
8.5.1	Burner Head Opening and Closing	43
8.6	Visual Inspections and Regulations for Installation	45
8.6.1	Connection to Vehicle Cooling System	45
8.6.2	Connection to Vehicle Fuel System	45
8.6.2.1	Fuel Lines	45
8.6.2.2	Fuel Filter	45
8.6.3	Combustion Air Supply	45
8.6.4	Exhaust Line	46
8.7	Removal and Installation	46
8.7.1	Heater, Removal and Installation	46
8.7.1.1	Removal	46
8.7.1.2	Installation	46
8.7.2	Temperature Limiter, Replacement	47
8.7.3	Temperature Thermostat, Replacement	47
8.7.4	Overheat Fuse, Replacement	47
8.7.5	Burner Head, Replacement	47
8.7.6	Ignition Coil, Replacement	47
8.7.7	Flame Detector (Photo Eye), Replacement	47
8.7.8	Combustion Chamber, Replacement	47
8.8	First Operation	47
8.8.1	Water Circuit, Bleeding	47
8.8.2	Fuel Supply System, Bleeding	48

9. Repair	49
9.1 General Information	49
9.1.1 Work on Components after Disassembly	49
9.1.1.1 Visual Inspection, General	49
9.1.1.2 Combustion Chamber, Visual Inspection	49
9.1.1.3 Heat Exchanger, Visual Inspection	49
9.1.1.4 Combustion Air Fan Wheel, Visual Inspection	50
9.2 Disassembly and Assembly	50
9.2.1 Overheat Fuse, Replacement	50
9.2.1.1 Removal	50
9.2.1.2 Installation	50
9.2.2 Temperature Control Thermostat, Replacement	50
9.2.2.1 Removal	50
9.2.2.2 Installation	50
9.2.3 Temperature Limiter, Replacement	51
9.2.3.1 Removal	51
9.2.3.2 Installation	51
9.2.4 Control Unit, Replacement	51
9.2.4.1 Removal	51
9.2.4.2 Installation	51
9.2.5 Burner, Replacement	51
9.2.5.1 Removal	51
9.2.5.2 Installation	51
9.2.6 Fuel Valve and Solenoid, Replacement	53
9.2.6.1 Removal	53
9.2.6.2 Installation	53
9.2.7 Fuel Pump, Replacement	53
9.2.7.1 Removal	53
9.2.7.2 Installation	53
9.2.8 Fuel Nozzle, Replacement	54
9.2.8.1 Removal	54
9.2.8.2 Installation	54
9.2.9 Flame Detector, Replacement	54
9.2.9.1 Removal	54
9.2.9.2 Installation	54
9.2.10 Ignition Electrodes, Replacement	55
9.2.10.1 Removal	55
9.2.10.2 Installation	55
9.2.11 Ignition Coil, Replacement	55
9.2.11.1 Removal	55
9.2.11.2 Installation	55
9.2.12 Drive Motor, Replacement	56
9.2.12.1 Removal	56
9.2.12.2 Installation	56
9.2.13 Combustion Air Fan, Replacement	57
9.2.13.1 Removal	57
9.2.13.2 Installation	57
9.2.14 Fan Replacement	58
9.2.15 Fan Shaft, Bearings and Gearing, Exploded View (DBW 2010)	59
9.2.16 Fan Shaft, Bearings and Gearing, Exploded View (DBW 2020 / DBW 300)	60

9.2.17	Combustion Chamber, Replacement	.61
9.2.17.1	Removal	.61
9.2.17.2	Installation	.61
9.2.18	Heat Exchanger, Replacement	.61
9.2.18.1	Removal	.61
9.2.18.2	Installation	.61
9.3	Coolant Circulating Pump Repair	.62
9.3.1	Removal	.62
9.3.2	Disassembling	.62
9.3.3	Assembling	.62
9.3.4	Installing	.62
9.4	MP School Bus Circulation Pump	.64
9.4.1	Removal	.64
9.4.2	Disassembling	.64
9.4.3	Assembling	.64
9.4.4	Installing	.64
10.	Instruments and Tools	65
10.1	Setting Gauge	.65
10.2	Tester	.65
10.3	CO2 Test Apparatus	.65
10.4	Smoke Number Test Apparatus	.65
10.5	Nozzle Wrench	.66
10.6	Fuel Pressure Gauge	.66
10.7	Grease and Locking Varnish	.66
11.	Product Information	67
11.1	ISS "White" Timer for the Scholastic Heater™	.67

1. INTRODUCTION

1.1 SCOPE AND PURPOSE

This repair shop manual is intended to support familiarized personnel in the repair of water heaters DBW 2010, 2020 and 300.

The water heater may only be operated with the fuel specified on the model plate and the relevant designated type of electrical connection.

1.2 APPLICABILITY OF MANUAL

This manual is applicable only for heaters identified on the title page.

1.3 MEANING OF WARNINGS, CAUTIONS AND NOTES

WARNINGS, CAUTIONS, and NOTES in this manual have the following meaning:



DANGER: This heading and text style is used to highlight that non-compliance with instructions or procedures will cause injuries or lethal accidents to personnel.



WARNING: This heading and text style is used to highlight that non-compliance with instructions or procedures may cause injuries or lethal accidents to personnel.



CAUTION: This heading and text style is used to highlight that non-compliance with instructions or procedures may cause damage to equipment.



NOTE: This heading and text style is used to highlight and draw attention to information we feel you would like to have. It could have to do with procedures and tips that will help you work more efficiently.

1.4 ADDITIONAL DOCUMENTATION TO BE USED

This workshop manual contains all information and procedures necessary for the repair of heaters DBW 2010, 2020 and 300.

The use of additional documentation is normally not necessary.

Operating instructions and installation instructions may be used as complementary information as necessary.

1.5 SAFETY INFORMATION AND REGULATIONS

The general safety regulations for the prevention of accidents and the relevant operating safety instructions have to be observed at all times.

"General Safety Regulations" beyond the scope of these regulations are detailed in the following.

The specific safety regulations applicable to this manual are highlighted in the individual chapters by Warnings, Cautions, and Notes.

1.5.1 GENERAL SAFETY NOTES

The year of first operation must be permanently marked on the identification label by removing the relevant number of the year.

The heaters are cleared for heating the vehicle engine and the passenger cabin. The use of the heater in vehicles not subject to the EU Directive 70/156/EEC (e.g. ships) is partly governed by regional regulations.

The heater may only be fitted in vehicles or in independent heating systems with a minimum coolant capacity of 10 liters for DBW 2010 and 15 liters for DBW 2020 and 300.

The heater must not be installed in the passenger or driver compartments of vehicles. Should the heater nevertheless be installed in such a compartment, the installation box must be sealed tight against the vehicle interior.

There must be sufficient ventilation of the installation box from the exterior in order not to exceed a maximum temperature of 85° C (185 °F) in the installation box. Excessive temperatures may cause malfunctions.



WARNING: Due to the danger of poisoning and suffocation the heater must not be operated, not even with timed operation, in enclosed areas such as garages or workshops not equipped with an exhaust venting facility.



WARNING: At filling stations and fuel depots the heater must be switched off to prevent explosions.



CAUTION: Where flammable fumes or dust may build up (e.g. in the vicinity of fuel, coal, wood, cereal depots, or similar installations) the heater must be switched off to prevent explosions. The heater must not be operated near flammable materials such as dry grass and leaves, cardboard boxes, paper, etc.

In the vicinity of the water heater a temperature of 85° C (185 °F) must not be exceeded under any circumstances (e.g. during body paint work).

A violation of this temperature limit may cause permanent damage to the electronics.

When checking the cooling water level proceed in accordance with the vehicle manufacturer's instructions.

The water in the heating circuit of the heater must contain a minimum of 20% of a quality brand anti-freeze.

Additives in the heating circuit must not affect metals, plastics and rubber and must leave no deposits.

The opening pressure in the vehicle cooling system - normally indicated on the radiator filler cap - must be between 0.4 and 2.0 bar above operating pressure (also applicable to separate heating circuits).

1.6 LEGAL PROVISIONS FOR INSTALLATION

DBW series heaters have been type-tested and approved in accordance with EG Directives 72/245/EEG (EMV) and 2001/56/EG (heater) with the following EG permit numbers:

e1*2001/56*0006*xx

Installation is governed above all by the provisions in Annex VII of Directive 2001/56/EC.



NOTE: *The provisions of these Directives are binding within the territory governed by EU Directive 70/156/EEC and should similarly be observed in countries without specific regulations.*

(Extract from Directive 2001/56/EC Annex VII)

“1.7.1. A clearly visible indicator within the user's field of vision must show when the heater is switched On or Off.”



NOTE: *For further notes and provisions relating to the installation of the heater in vehicles, refer to the installation instructions.*

IMPORTANT!

Failure to follow the installation instructions and the notes contained therein will lead to all liability being refused by Webasto. The same applies if repairs are carried out incorrectly or with the use of parts other than genuine spare parts. This will result in the invalidation of the type approval for the heater and therefore of its homologation / EC type licence.

Installation Instructions for Webasto fuel tanks for the fuel supply of water heaters in vehicles:

- in vehicles the installation is not permitted in the passengers' or driver's compartment.
- the fuel filler neck must not be located in the passengers' or driver's compartment of any vehicle.
- fuel containers must either be equipped with a vent cap or any other type of ventilation (vent line).

Only vent caps in accordance with DIN 73400 may be used.

All fuel containers offered in the Webasto Accessories Catalogue are suitable for a maximum operating pressure of 0.15 bar overpressure.

All fuel containers offered in the Webasto Accessories Catalogue are subjected during manufacture to individual pressure testing with at least 0.3 bar overpressure.

- The operational state of the heater, i.e. at least an indication "on" or "off" must be easily and clearly visible.

For heaters in vehicles not ruled by the EU Directive but other regulations, the acceptance by the relevant authority is required as applicable.

1.7 CORRECTIONS AND IMPROVEMENTS

Deficiencies, improvements, or proposals for correction of this workshop manual are to be mailed to:

**WEBASTO PRODUCT NORTH AMERICA, INC.
TECHNICAL DOCUMENTATION GROUP
15083 NORTH ROAD
FENTON MI 48430**

2. GENERAL DESCRIPTION

The water heaters Webasto DBW 2010, DBW 2020, DBW 300 and Scholastic Heater™ are used in combination with the vehicle's own heating installation to:

- heat the passenger compartment
- defrost the windshield
- preheat water-cooled engines
- in self-contained cargo heating applications

The water heater operates independent from the vehicle engine and is connected to the vehicle cooling system, the fuel system and the electrical system.

The heater is designed to the heat exchanging principle and operates intermittently, controlled by the temperature control thermostat.

The heaters DBW 2010, DBW 2020, DBW 300 and Scholastic Heater™ basically consist of:

- the combustion air intake (adjustable)
- the combustion air fan and motor
- the fuel pump
- the fuel control valve and solenoid
- the nozzle holder and nozzle
- the ignition coil and ignition electrodes
- the combustion chamber
- the heat exchanger

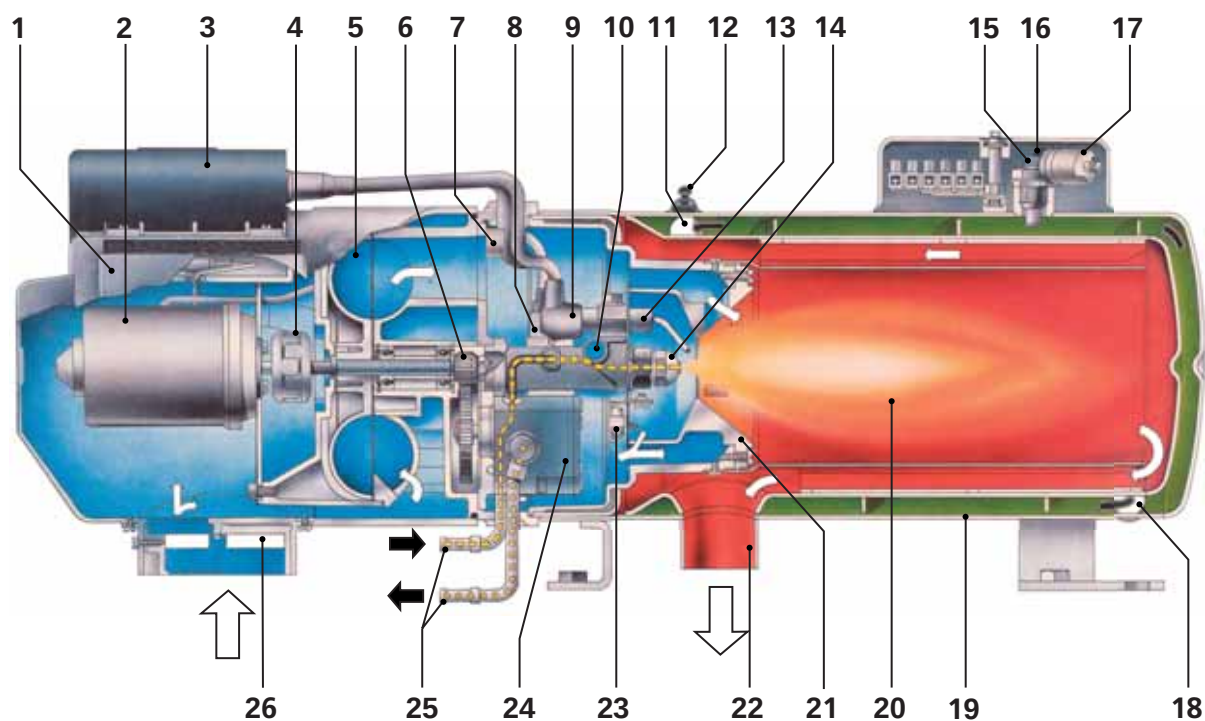
For control and monitoring, the heater includes:

- a control unit
- an overheat fuse (non-reset)
- a temperature limiter
- a temperature control thermostat
- a flame detector (photo eye)

A coolant circulating pump is installed directly to the heater or inside an enclosure or on a tray mount.

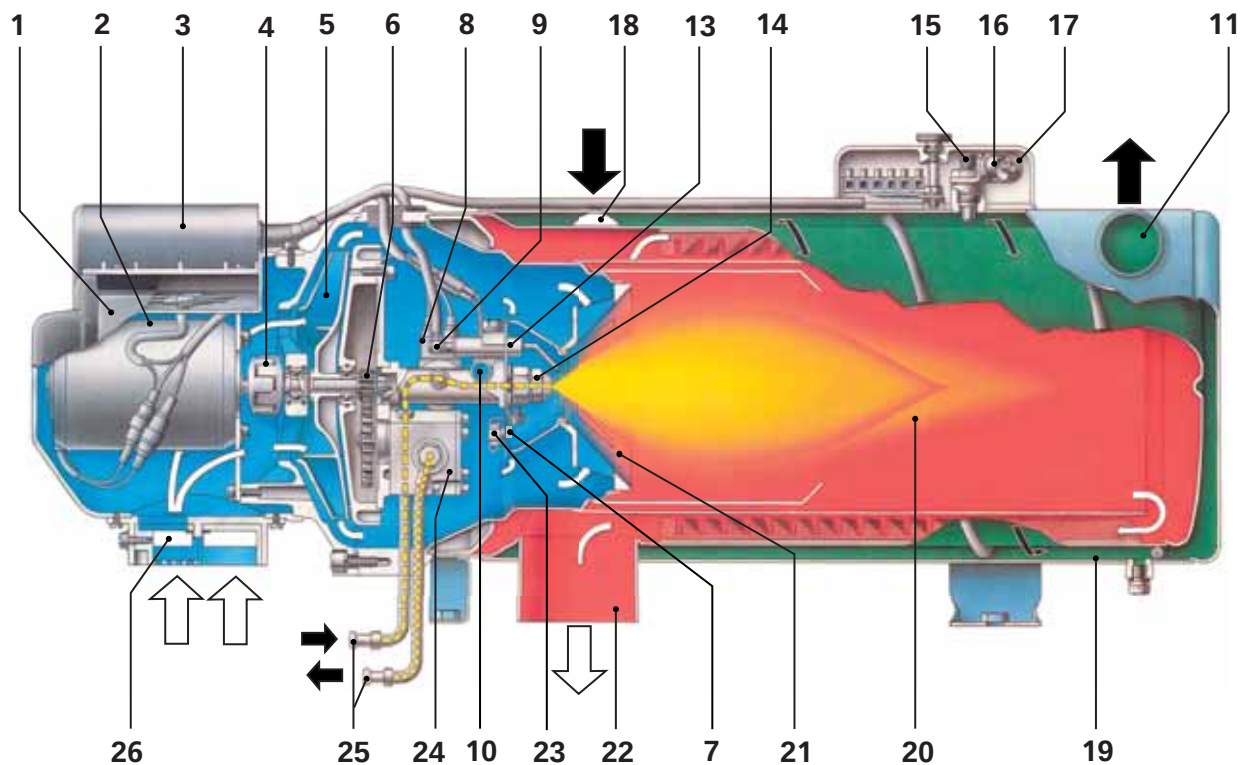
The heaters may also be equipped with an optional cold starting aid consisting of:

- a preheat thermostat
- a nozzle holder preheat cartridge
- a relay and wiring harness

**DBW 2010**

- | | | |
|--|---|--|
| 1. Electronic control unit | 10. Pre-heater | 18. Coolant inlet |
| 2. Motor | 11. Coolant outlet | 19. Heat exchanger |
| 3. Electronic ignition unit | 12. Bleeding valve | 20. Combustion chamber |
| 4. Coupling (clutch) | 13. Ignition electrodes | 21. Combustion air swirler |
| 5. Combustion air fan | 14. Fuel nozzle | 22. Exhaust outlet |
| 6. Toothed gearing | 15. Overheat fuse (white wires) | 23. Flame detector |
| 7. Preheat thermostat (blue and green wires) | 16. Temperature control thermostat (green and red wires)* | 24. Fuel pump |
| 8. Fuel control valve and solenoid | 17. Temperature limiter (green wires) | 25. Fuel pipes |
| 9. Electrode holder | | 26. Combustion air intake with adjusting shutter |

*Lower temperature version of the temperature control thermostat has white and orange wires.



DBW 2020 DBW 300

- | | | |
|--|--|--|
| 1. Electronic control unit | 10. Pre-heater | 18. Coolant inlet |
| 2. Motor | 11. Coolant outlet | 19. Heat exchanger |
| 3. Electronic ignition unit | 12. Bleeding valve | 20. Combustion chamber |
| 4. Coupling (clutch) | 13. Ignition electrodes | 21. Combustion air swirler |
| 5. Combustion air fan | 14. Fuel nozzle | 22. Exhaust outlet |
| 6. Toothed gearing | 15. Overheat fuse (white wires) | 23. Flame detector |
| 7. Preheat thermostat (blue and green wires) | 16. Temperature control thermostat (green and red wires) | 24. Fuel pump |
| 8. Fuel control valve and solenoid | 17. Temperature limiter (green wires) | 25. Fuel pipes |
| 9. Electrode holder | | 26. Combustion air intake with adjusting shutter |

2.1 PARTS OF THE HEATER

2.1.1 ELECTRONIC CONTROL UNIT (1)

The control unit SG 1553 in 12 volt and 24 volt versions is the central component to ensure controlled operation and monitoring of combustion.

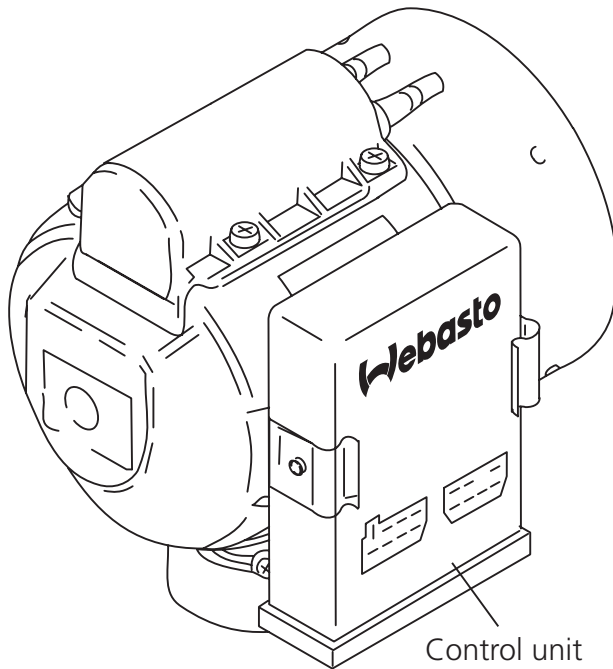


Figure 1: Control Unit

2.1.2 OVERHEAT FUSE (15)

The overheat fuse protects the heater from too high and inadmissible temperatures. The overheat fuse contains a fusible link that reacts when the temperature exceeds 138° C (280° F), and switches the heater off with a purge cycle.

Overheat Fuse (white wires)

Response temperature
138° C (280° F)

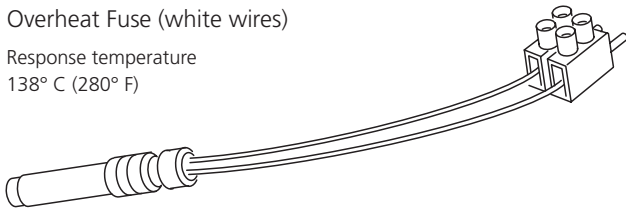


Figure 2: Overheat Fuse

2.1.3 TEMPERATURE LIMITER (17)

The temperature limiter is a thermostat that responds (opens) at a temperature of 95° C (203° F). The temperature limiter will automatically reset (closes) once temperature falls well below 95° C (203° F). Once the limiter has reset, the heater will have to be switched off and back on to restore operation.

Temperature Limiter (green wires)

Switching temperature
– opens at 95° C (203° F)

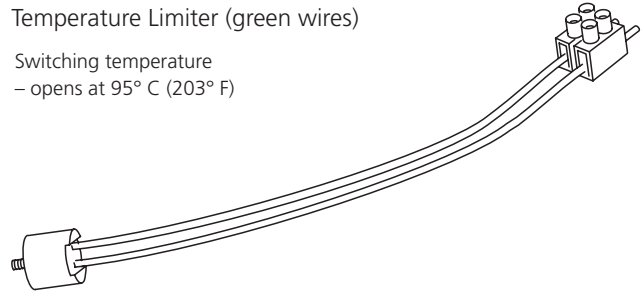


Figure 3: Temperature Limiter

2.1.4 TEMPERATURE CONTROL THERMOSTAT (16)

After the operating temperature has been reached, the temperature control thermostat opens and shuts off the heating cycle and a purge cycle begins. Once the operating temperature drops to the lower temperature threshold of the control thermostat, the thermostat closes and another heating cycle begins, thus, maintaining a consistent coolant temperature.

Temperature Control Thermostat

Version 1 (red and green wires)
– opens at 75 ± 3° C (167 ± 6° F)
– closes at 68 ± 5° C (154 ± 9° F)

Version 2 (orange and white wires)
– opens at 70 ± 3° C (158 ± 6° F)
– closes at 60 ± 5° C (140 ± 9° F)

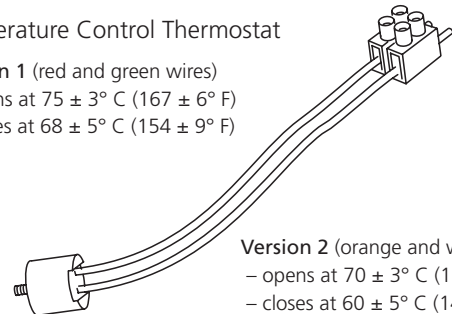


Figure 4: Temperature Control Thermostat



NOTE: DBW 2020/300 Only. An optional control thermostat could be mounted in the heating system in place of the control thermostat located on the heater.

2.1.5 FLAME DETECTOR (23)

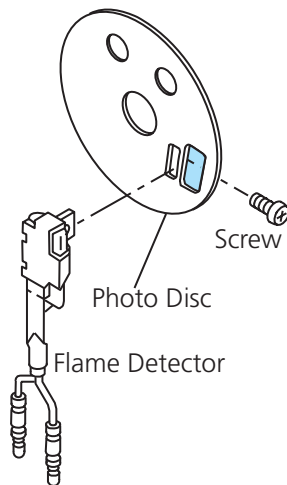


Figure 5: Flame Detector and Photo Disc

The flame detector is a photosensitive, varying resistance element that supplies a “flame” or “no flame” signal to the control unit.

IMPORTANT! *The photo disc to which the flame detector is attached must be flat and free floating over the nozzle and electrodes.*

2.1.6 COMBUSTION AIR INTAKE (26)

The air intake socket provides regulation of the combustion air quantity to the fuel quantity atomized by the high-pressure atomizer nozzle.

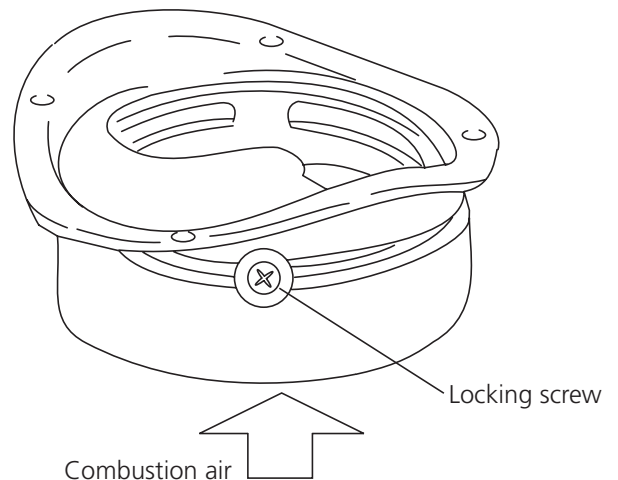


Figure 6: Combustion Air Intake Bellows

2.1.7 COMBUSTION AIR FAN (5) AND MOTOR (2)

The combustion air fan supplies the air necessary for combustion.

There are two different fan designs in use:

DBW 2010 — lateral canal fan

DBW 2020/300 — radial fan

The motor, through a coupling, drives the combustion air fan, and through a toothed gearing, the fuel pump.

Rated motor r.p.m.:	DBW 2010	4500 RPM
	DBW 2020	5000 RPM
	DBW 300	5800 RPM

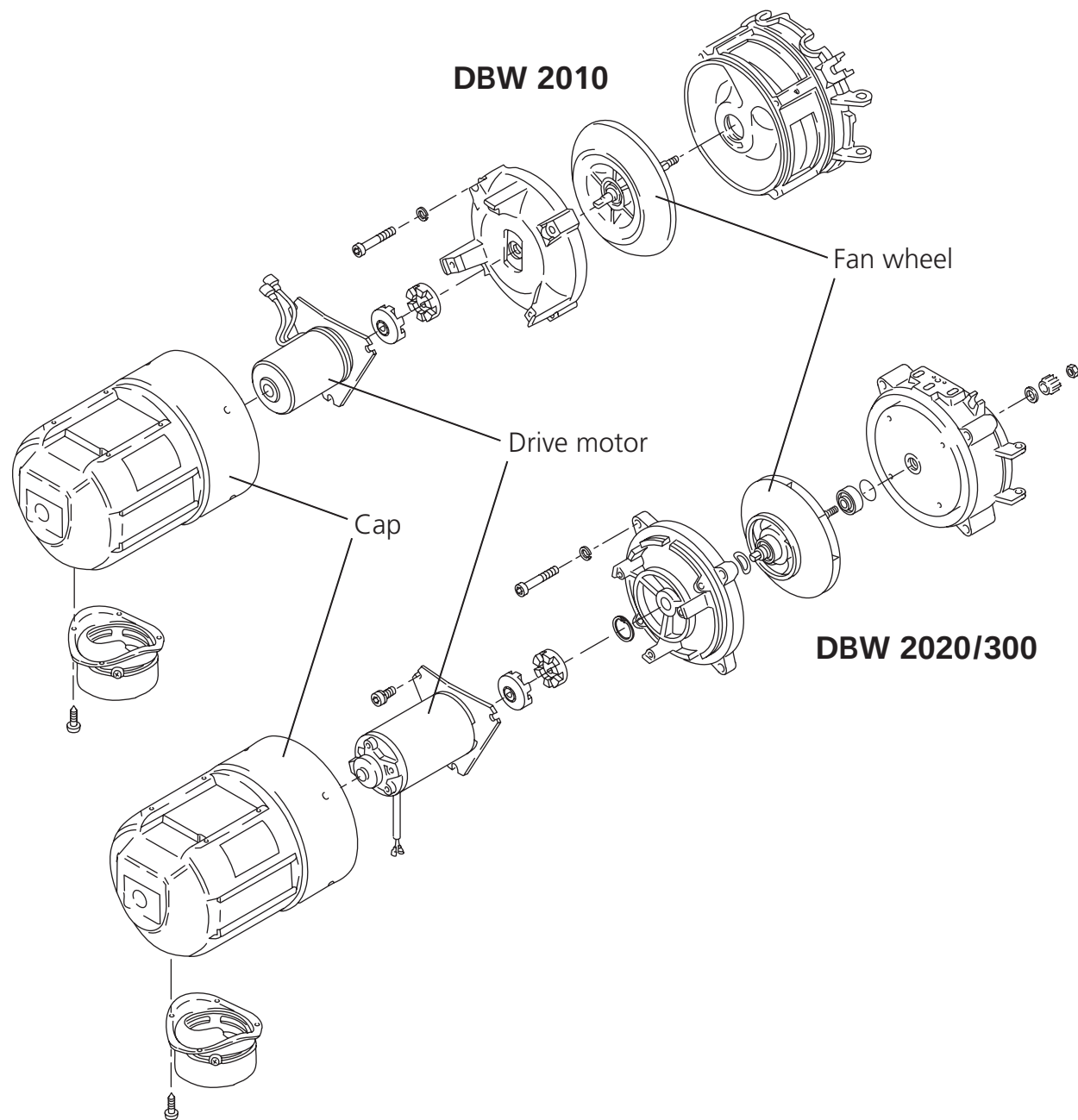


Figure 7: Combustion Air Fans

2.1.8 COUPLING (4)

The coupling (clutch) provides the mechanical connection between the motor and the combustion air fan.

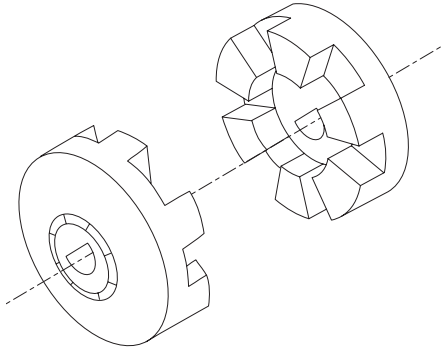


Figure 8: Motor to Fan Coupling (Clutch)



NOTE: Before reusing the coupling, it has to be checked for cracks, wear and the condition of the flat portion of the center shaft hole. Too much play on the shaft will result in a load continuous noise.

2.1.9 TOOTHED GEARING (6)

The gears drive the fuel pump with a gear ratio of 1:3.5.

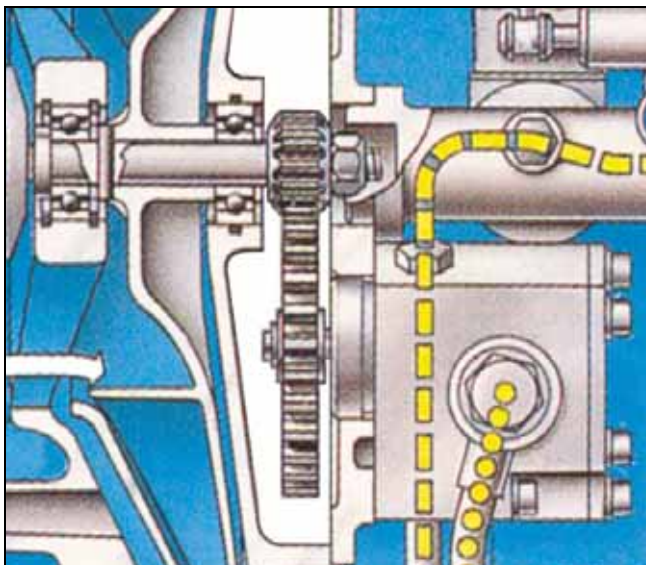


Figure 9: Fuel Pump Drive Gearing



NOTE: If signs of wear are showing within the sector of the toothed gearing as well as at the flat portion of the shaft hole of the large gear, the gears will have to be replaced.

2.1.10 FUEL PUMP (24)

The fuel pump (single-staged toothed gear pump) delivers the fuel from the tank to the heater and brings it to a pressure of 10 ± 0.5 bar (145 ± 7 psi) for DBW 2010*, DBW 2020 and DBW 300.

*DBW 2010 equipped with a 0.35 Gal/hr. nozzle only.

For DBW 2010 with 0.40 Gal/hr. nozzle, the fuel pressure should be set to $8 - 0.5$ bar ($116 - 7$ psi).

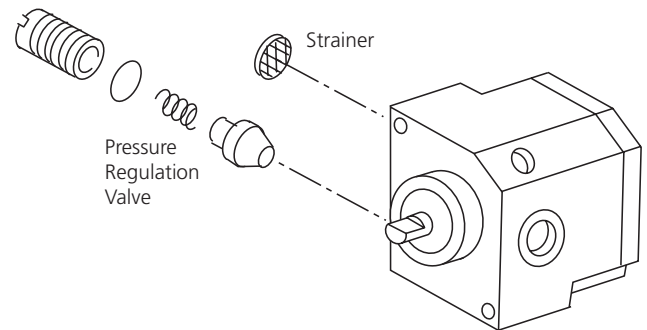


Figure 10: Fuel Pump Assembly

2.1.11 FUEL CONTROL VALVE AND SOLENOID (8)

The fuel solenoid valve interrupts the fuel supply to the atomizer nozzle when the heater is switched off and during a control pause period. When there is no current present, the solenoid valve is closed.

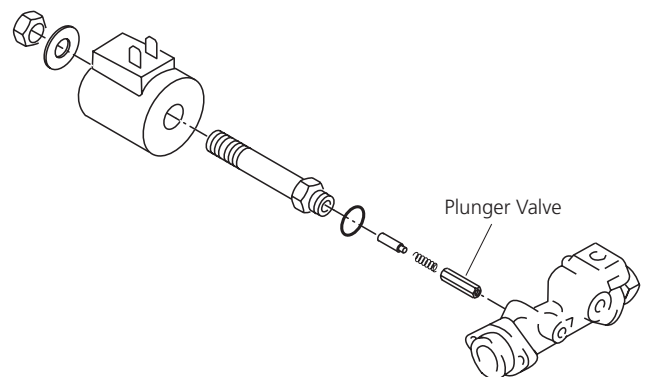


Figure 11: Fuel Solenoid Assembly

2.1.12 FUEL NOZZLE AND NOZZLE HOLDER (14)

The fuel atomizing nozzle is screwed into the nozzle holder. Under pressure, the fuel nozzle atomizes the fuel entering the combustion chamber.

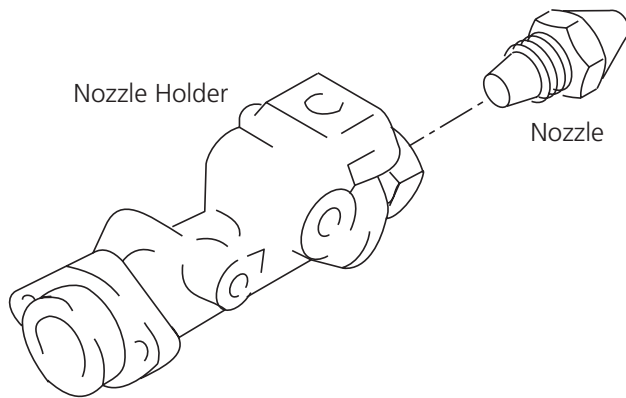


Figure 12: Nozzle Holder and Nozzle

2.1.13 FUEL LINE CONNECTIONS (25)

Fuel lines from the fuel tank are connected to the suction and return pipes of the heater in the case of the DBW 2010/2020/300.

The Scholastic Series heater use a single fuel line that is connected to the suction pipe of the heater. There is no return fuel line on this model.

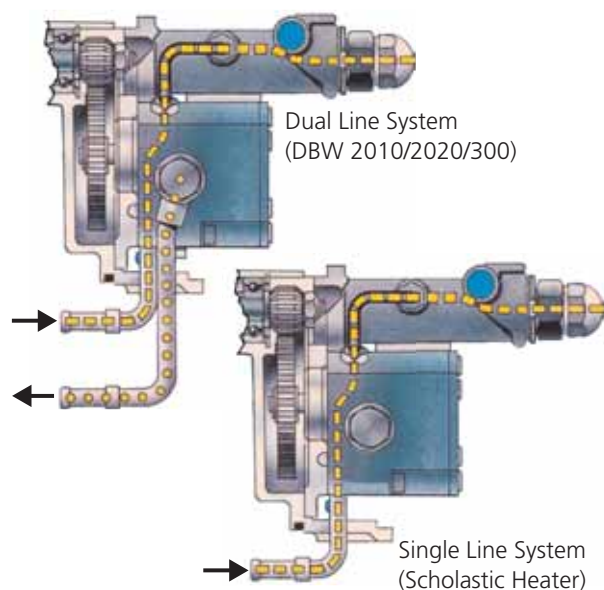


Figure 13: Fuel Pumps

2.1.14 ELECTRONIC IGNITION UNIT (3)

The electronic ignition unit develops high voltage of approximately 8000 volts to produce a spark at the tips of the ignition electrodes. The electronic ignition unit is only in operation during the starting phase.

IMPORTANT! Never switch on the electronic ignition unit without being connected to the ignition electrodes!

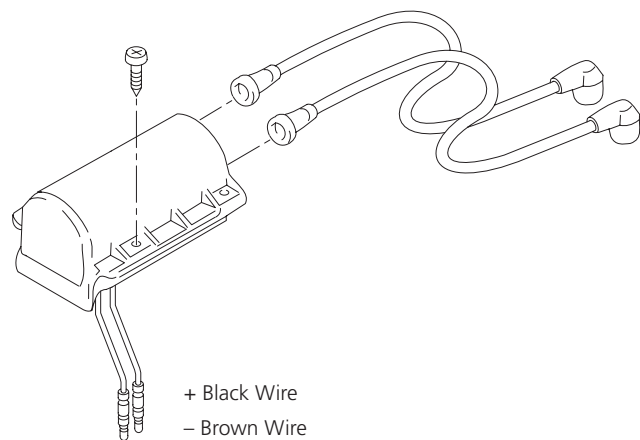


Figure 14: Electronic Ignition Unit

2.1.15 IGNITION ELECTRODES (13)

The ignition spark is formed between the points of the ignition electrodes, thus starting the combustion process.

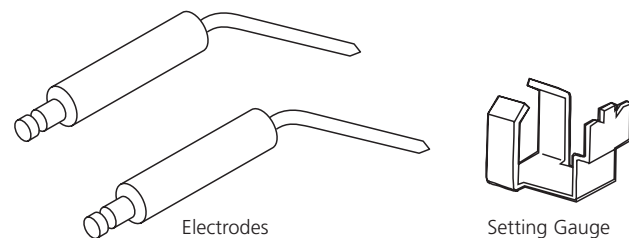


Figure 15: Ignition Electrodes and Setting Gauge

2.1.16 COMBUSTION CHAMBER (20), COMBUSTION AIR SWIRLER (21)

Within the burner tube of the combustion chamber, the air-fuel mixture is burned.

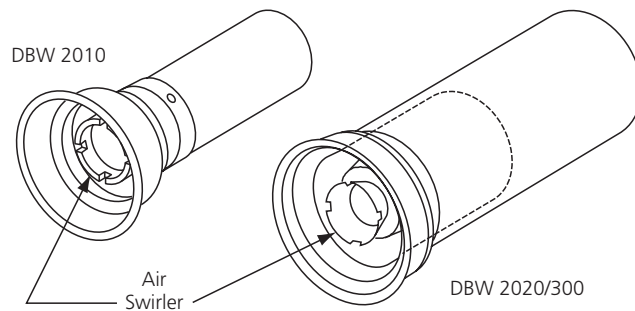


Figure 16: Combustion Chambers

2.1.17 HEAT EXCHANGER (19)

The heat, produced by the combustion process, is transferred to the coolant (water-antifreeze mixture) flowing through the heat exchanger.

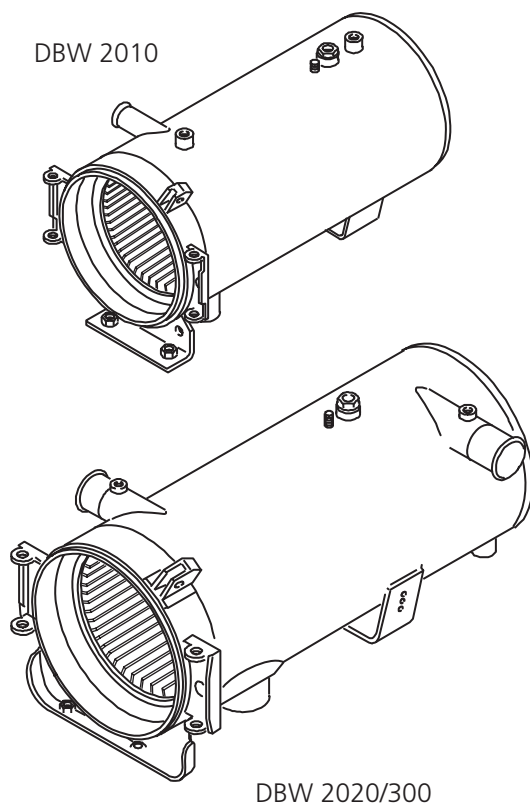


Figure 17: Heat Exchangers

2.1.18 PREHEAT THERMOSTAT (7)

The preheat thermostat is installed in the burner head on the back wall (DBW 2010) or on the photo disc (DBW 2020/300). It switches the nozzle holder pre-heating element (10) on which warms the fuel inside the nozzle holder to ensure fuel atomization in severe cold conditions.

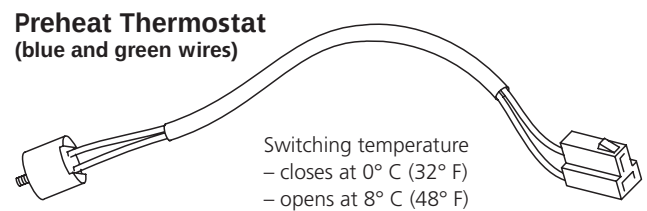


Figure 18: Preheat Thermostat

2.1.19 PRE-HEATER CARTRIDGE (10)

The pre-heater is a heating element located in the fuel nozzle holder. Operated by the preheat thermostat (7), it heats the fuel inside the nozzle holder when the temperature drops below 0° C (32° F).

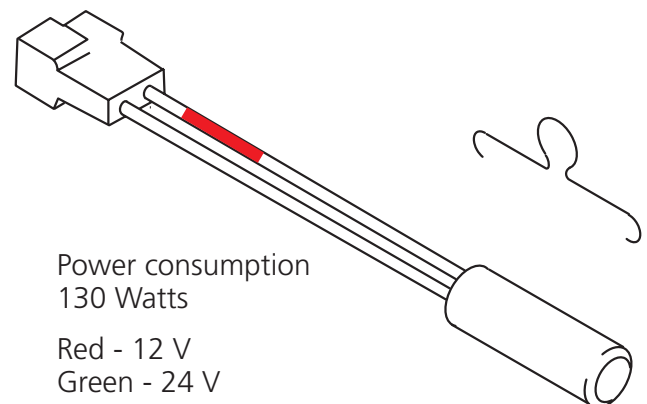


Figure 19: Heating Cartridge

2.1.20 COOLANT CIRCULATING PUMP

The externally mounted circulation pump ensures proper coolant circulation in the vehicle and heater circuit. The pump is activated by the control unit to operate as long as the heater is in operation.

The heaters may be operated with circulation pump U 4810 or U 4846 for the DBW 2010 heater, the U 4814, or U 4851 for the DBW 2020 and 300 heaters and a school bus specific, MP coolant pump for the Scholastic Heater™.

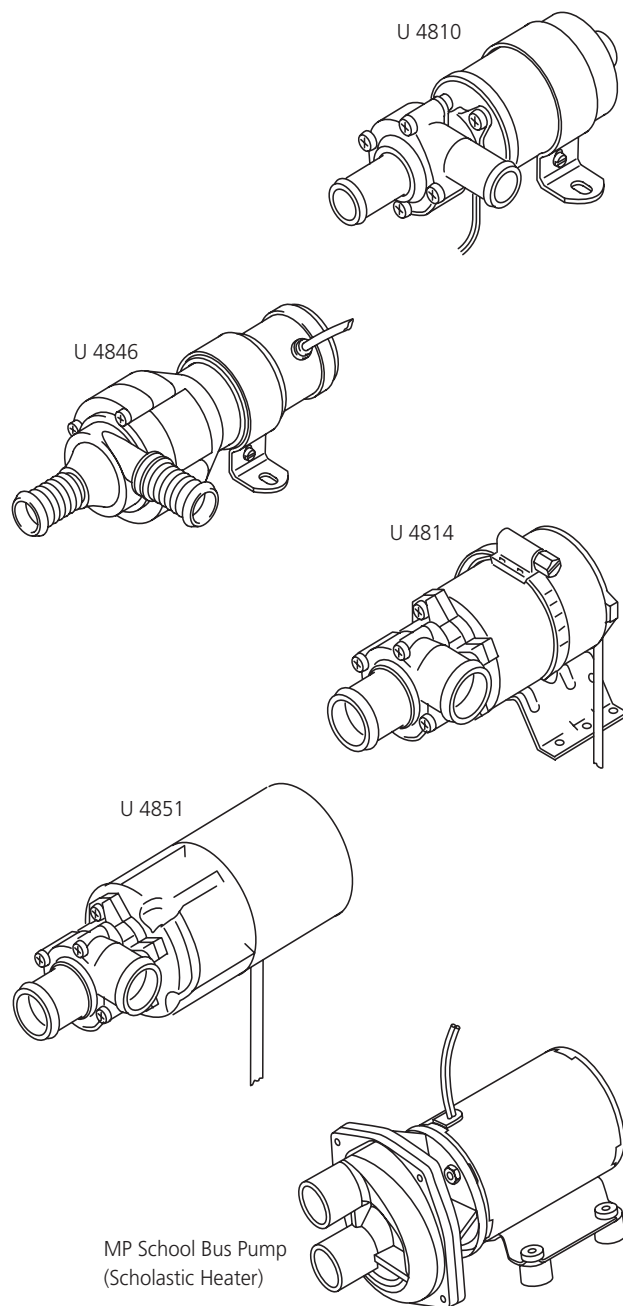


Figure 20: Coolant Circulating Pumps

3. FUNCTIONAL DESCRIPTION

3.1 SWITCH ON

Upon switching on the Webasto heater, the operation indicator lamp (A) comes on, the heater motor (C) and the coolant circulating pump (B) begin to run. After about 10 - 25 seconds, the solenoid valve (E) opens and fuel is sprayed into the combustion chamber. At the same time, the electronic ignition unit (D) produces high voltage (8000V) and the fuel - air mixture in the combustion chamber is ignited by the spark on the ignition electrodes. The flame is detected by the flame detector (F), then the electronic ignition unit stops producing high voltage and combustion continues on its own (spark on electrodes is required only to ignite the flame). At this time the heater is working and produces heat.

3.2 HEATING OPERATION

After reaching operating temperature the control unit in conjunction with the temperature control thermostat takes over to provide controlled operation by activation and deactivation of the burner in order to maintain a nearly constant temperature of the heat exchanger (coolant).

The heating operation is terminated as soon as the upper operating point on the temperature control thermostat is exceeded.

The heater now starts the control idle period. Heater operation is resumed when the temperature drops below the lower operating point of the temperature control thermostat.

CONTROL IDLE PERIOD

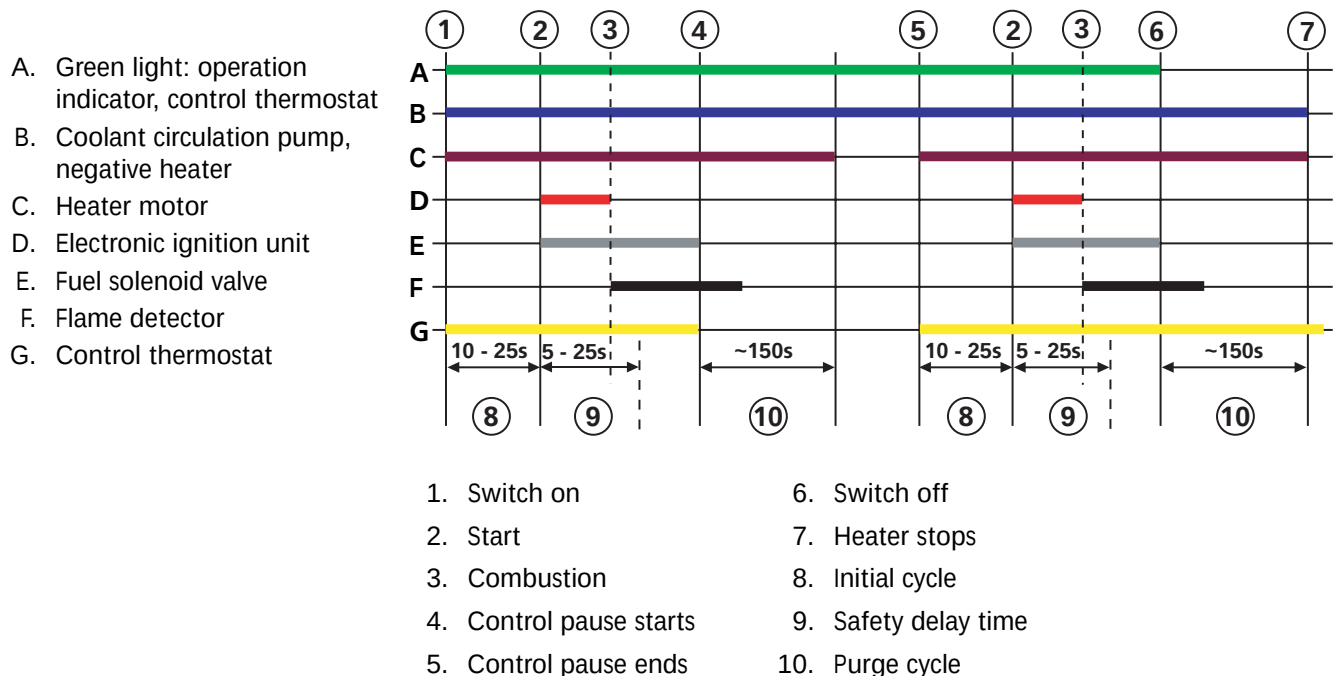
A rise in temperature above the upper operating point makes the solenoid valve in the fuel pump shut off the fuel supply initiating the run-down. The flame extinguishes, the combustion air fan and the circulation pump however continue their operation. After approximately 150 seconds run-down is completed with deactivation of the combustion air fan.

The circulation pump remains in operation during the control idle period. The operating indicator light also remains on.

3.3 SWITCH OFF

Switching off the heater stops combustion. The operating indicator light remains on and run-down commences. The combustion air fan and circulation pump are deactivated after approximately 150 seconds. The operating indicator light goes out to indicate the heater is now fully off.

Reactivation of the heater during run-down is permitted. The burner immediately resumes operation after the run-up time.



4. TECHNICAL DATA

Unless tolerances are shown within the technical data table, a tolerance of $\pm 10\%$ applies at an ambient temperature of $+20\text{ }^{\circ}\text{C}$ ($+68\text{ }^{\circ}\text{F}$) and at the rated voltage and conditions.

ELECTRICAL COMPONENTS

Control unit, fan and circulation pump motors, solenoid valve, ignition coil, heater cartridge for nozzle block pre-heater and timer are designed either for 12-volt or 24-volt operation. Temperature limiter, overheat fuse, flame detector (photo eye), temperature control thermostat, preheat thermostat and switches are voltage independent components.



NOTE: *The allocation of circulation pumps to heater units must be in accordance with coolant resistances.*

FUEL FOR DBW SERIES (DIESEL/HEATING OIL/KEROSENE):

Diesel fuel, heating oil and kerosene are suitable fuels for the heater.

The Diesel fuel specified by the vehicle manufacturer is suitable as fuel for the heater. Any negative effect caused by additives is not known. When the fuel for the heater is drawn from the vehicle's fuel tank, the vehicle manufacturer's specifications concerning additives are to be observed. Any addition of waste oil is not permitted.

When changing to cold-resistant fuels, the heater must be operated for approx. 10 minutes to ensure that the fuel pump, nozzle holder, nozzle and lines are filled with the new fuel.

When using fuel from a separate fuel tank and at temperatures below 0°C , winter Diesel fuel must be used.

4.1 TECHNICAL DATA OF THE HEATERS

HEATER	DBW 2010	DBW 2020	DBW 300
DESIGN	Coolant heater with high-pressure nozzle		
HEAT OUTPUT kW (Btu/h)	13.0 (45,000)	23.3 (80,000)	30.0 (104,000)
FUEL	Diesel #1, #2, Arctic and Kerosene		
FUEL CONSUMPTION l/h (gal/h – US) (gal/h – Imp.)	1.5 (0.4) (0.3)	3.0 (0.8) (0.7)	4.0 (1.2) (0.9)
RATED VOLTAGE V	12 or 24		
OPERATING VOLTAGE V	10-14 or 20-28		
POWER CONSUMPTION OF HEATER (WITHOUT COOLANT CIRCULATION PUMP)	60 Watts	120 Watts	130 Watts
PERMISSIBLE AMBIENT TEMPERATURE DURING OPERATION OF HEATER, CONTROL UNIT AND COOLANT CIRCULATION PUMP: °C (°F)	– 40... + 60 (– 40... + 140)		
PERMISSIBLE STORAGE TEMPERATURE CONTROL UNIT: °C (°F) HEATER, COOLANT CIRCULATION PUMP: °C (°F)	+ 85 max. (+ 185 max.) – 40... + 85 (– 40... + 185)		
MIN. CAPACITY OF COOLING SYSTEM liter (gal. – US) (gal. – Imp.)	10 2.65 2.2	15 3.96 3.3	
PERMISSIBLE OPERATING PRESSURE OF THE COOLANT bar (psi)	0.4-2.0 (6-29)		
CO ₂ IN EXHAUST GASES% BY VOL.	10.5... 11.0		
CO IN EXHAUST GASES% BY VOL.	0.2 max.		
SMOKE NUMBER (BOSCH)	3.0 max.		
DIMENSIONS OF THE HEATER INCL. CONTROL UNIT mm (inch)	L W H 584 (23) 205 (8.1) 228 (9.0)	680 (26.7) 240 (9.5) 279 (11.0)	
WEIGHT OF HEATER INCL. CONTROL UNIT kg (lb)	15 (33)	22 (48.5)	



NOTE: Specifications for the Scholastic Heater are the same as the DBW 2010 heater unless otherwise specified.

4.2 TECHNICAL DATA OF THE CIRCULATING PUMPS

CIRCULATING PUMP		U 4810	U 4846	U 4814	U 4851	MP Pump
FLOW RATE	l/h (gal/h – US)	1600 (7.0) against 0.15 bar	1650 (7.26) against 0.15 bar	5200 (22.9) against 0.2 bar	6000 (26.4) against 0.4 bar	3406 - 4542 (15 - 20)
NOMINAL VOLTAGE		12 or 24	12 or 24	12 or 24	24	12
OPERATING VOLTAGE		10-14 or 20-28	10-14 or 20-28	10-14 or 20-28	20-28	10-14
POWER CONSUMPTION	Watt	25	30	104	209	72
DIMENSIONS	L	166 (6.5)	180 (7.0)	248 (9.76)	285 (11.22)	214 (8.42)
	W	94 (3.7)	74 (2.9)	100 (3.9)	115 (4.53)	106 (4.16)
	H	77 (3.0)	112 (4.4)	106 (4.17)	118 (4.64)	106 (4.16)
WEIGHT	kg (lb)	0.8 (1.8)	22 (48.5)	2.1 (4.6)	2.8 (6.17)	2.5 (5.5)
RECOMMENDED FOR HEATER*		DBW 2010	DBW2010	DBW 2020 DBW 300	DBW 2020 DBW 300	Scholastic Heater™

*Choice of circulating pump depends on resistance of coolant circuit.

4.3 PERMISSIBLE EXTENSION OF THE CONNECTIONS

HEATER		DBW 2010	DBW 2020	DBW 300	Scholastic Series
FUEL LINE:					
internal diameter	mm (inch)	6* (0.25)	6* (0.25)	6* (0.25)	6* (0.25)
maximum length	m (ft)	10 (33)	10 (33)	10 (33)	10 (33)
suction head	m (ft)	2 (6.6)	2 (6.6)	2 (6.6)	2 (6.6)
COMBUSTION AIR INTAKE PIPE:					
internal diameter	mm (inch)	80 (3.2)	80 (3.2)	80 (3.2)	80 (3.2)
maximum length	m (ft)	5 (16.5)	5 (16.5)	5 (16.5)	5 (16.5)
maximum degree of bends total	m (ft)	270°	270°	270°	270°
EXHAUST PIPE:					
internal diameter	mm (inch)	38 (1.5)	70 or 80** (2.75 or 3.2**)	70 or 80** (2.75 or 3.2**)	38 (1.5)
maximum length	m (ft)	5 (16.5)	5 (16.5)	5 (16.5)	5 (16.5)
maximum degree of bends total	m (ft)	270°	270°	270°	270°
HOSE CONNECTIONS - INLET/OUTLET					
outside diameter	mm (inch)	18 (0.75)	38 (1.5)	38 (1.5)	25 (1.0)
TEMPERATURE DIFFERENCE BETWEEN INLET and OUTLET (ΔT)	°C (°F)	10 (18)	10 (18)	10 (18)	10 (18)

*Other dimensions upon request.

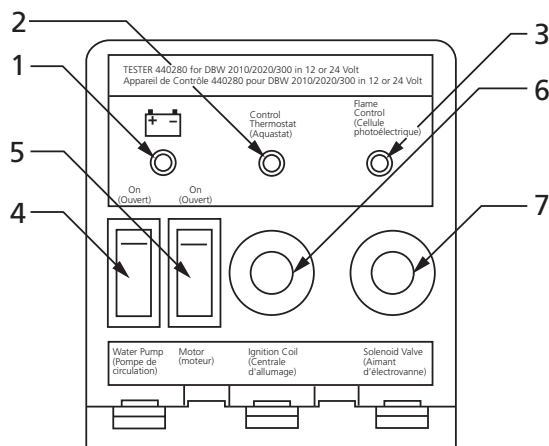
**Heaters built until model number DBW 2020.31 and DBW 300.10 inclusively.

5. TROUBLESHOOTING

5.1 QUICK CHECK TROUBLESHOOTING MATRIX

PROBLEM		CHECK, REPAIR OR REPLACE AS NECESSARY																				
		Voltage Supply	Electrical Fuse	Electrical Harness and Connections	Inertia Switch (Scholastic Heater Only)	ON / OFF Switch or Wiring	Overheat Fuse (White Wires)	Temperature Limiter (Green Wires)	Control Thermostat (Green and Red Wires)	Flame Detector (Photo-cell)	Ignition Electrodes	Ignition Coil – Coil Wires	Electric Motor	Fuel Supply	Fuel Pump	Fuel Solenoid Valve	High Pressure Nozzle	Coolant Circulating Pump	Combustion Air Intake	Exhaust System	Heating System	
Switch On	No Function	●	●	●	●	●		●														
Control Light	OFF after 30 Seconds						●	●		●	●	●	●	●	●	●						
Blower Motor in Unit	Inoperative	●	●	●	●			●		●			●									
Blower Motor in Unit	No Prime Cycle	●			●					●												
Blower Motor in Unit	No After-run				●					●												
Coolant Circulating Pump	Inoperative	●	●	●						●			●									
Ignition Spark	Absent		●	●						●	●		●									
Combustion	Does Not Take Place					●	●			●	●	●		●	●	●	●					
Combustion	Stops After 30 Seconds	●		●						●	●											
Combustion	Cannot Be Stopped					●					●					●						
During Combustion	Light Color Smoke												●	●			●					
During Combustion	Dark Color Smoke	●			●							●	●					●	●			
Heating Unit	Overheating			●				●		●							●				●	

5.2 TESTER INSTRUCTIONS (TESTER P/N 1302691A)



- 1 LED – input power to heater
- 2 LED – control thermostat
- 3 LED – flame detector
- 4 On/Off switch – water pump
- 5 On/Off switch – motor
- 6 Push Button – ignition spark coil
- 7 Push Button – fuel solenoid valve

The tester unit has been designed to quickly check the proper operation of the various heater components. By using the tester in place of the heater control unit, you are able to manually control the heater to test components and actually operate the unit in heating mode.

The actual testing is completed in two steps, first you perform an individual component test and then a manual start and run test, both designed to pinpoint actual problems in the heater system.

The tester should be used in conjunction with this Service and Repair Manual (P/N 699745) which details complete troubleshooting and repair procedures.

5.2.1 TEST PROCEDURES

SETUP:

- A. Remove connector blocks from heater control unit, inspect for loose wires, corrosion and proper wire connections.
- B. Plug control unit connector blocks into tester.
- C. Set heater switch/timer to “ON” and turn vehicle heater valve to “FULL” mode (if equipped).
- D. Proceed to component test procedures.

COMPONENT TEST PROCEDURES:

Test Step	Result	If not
Tester connected	BATTERY LED (1) unit lights up CONTROL THERMOSTAT LED (2) lights up	- test input voltage at control terminals B4(+) and B2(-) - check battery connections - check battery voltage - test switch/ timer - test control thermostat on heater Normal operating range - approx. 75 °C (167 °F) or higher open (no heat required) - approx. 68 °C (155 °F) or lower closed (heat required)
Push FUEL SOLENOID VALVE button (7) several times	clicking of solenoid should be heard	- test temperature fuse (if equipped) - test overheat limiter - test solenoid valve
Push IGNITION SPARK COIL button (6)	sparking should be heard	- check electrode gap - test ignition spark coil
Turn MOTOR switch (5) "ON"	motor should run	- reset *inertia switch (Scholastic Heater Only) - test motor
Turn WATER PUMP switch (4) "ON"	pump should run	- test pump

Table 1. Test procedures and result

*** INERTIA SWITCH:**

All Scholastic heaters are equipped with a manual reset inertia switch located on the tray floor near the coolant pump. The switch has a round red diaphragm and about the size of a 25 cent piece on top.

The purpose of this switch is to stop heater operation in the event the vehicle is involved in an accident or receives a strong impact shock, e.g. hitting a curb. When the switch responds, the fan motor circuit is interrupted thus stopping air and fuel delivery.

Always check to make certain the inertia switch has not been tripped. Resetting is accomplished by depressing the red diaphragm on top of the switch. You should hear an audible click whenever the switch is reset.

MANUAL TEST RUN OF HEATER:

- A. Turn the WATER PUMP switch (4) ON
- B. Turn the MOTOR switch (5) ON
- C. Push and hold the FUEL SOLENOID VALVE button (7) ON (starts fuel flow to combustion chamber)
- D. Push and hold the IGNITION SPARK COIL button (6) ON (starts electrodes sparking) until combustion has taken place.



NOTE: Hold IGNITION SPARK COIL button (5) ON until FLAME DETECTOR LED (3) lights or combustion is heard, then release; in any case do not hold button on for more than 15 seconds or damage to the coil may result.

TEST RESULTS:

1. LED (3) lights and combustion achieved
 - operation normal
2. Combustion achieved but no LED (3) light
 - check flame detector
3. Combustion not achieved and no LED (3) light
 - check fuel nozzle
 - check fuel pressure
 - check for blocked fuel lines (dirt or ice)
 - check ignition electrodes for damage and set gap
- E. Heater should now be in heating mode and will continue to run until you release the fuel solenoid valve button (7) which stops fuel flow and extinguishes the flame immediately. Allow the heater to continue running for approximately 30 seconds (cool down) after which, turn the WATER PUMP switch (4) and the MOTOR switch (5) OFF.



NOTE: If flame does not stop when the FUEL SOLENOID VALVE button (7) is released, turn MOTOR switch (5) OFF to stop heater. Check and repair fuel solenoid valve accordingly.

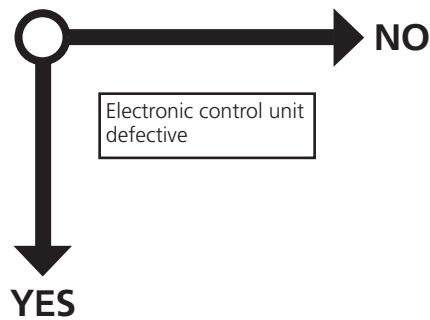
- F. Once the manual test run has been successfully completed, set the heater switch or timer to OFF, remove the tester and reconnect the control unit. Once done, set the switch or timer to ON. If the heater or a heater component does not respond, the control unit is defective. Replace the control unit and retest the heater.



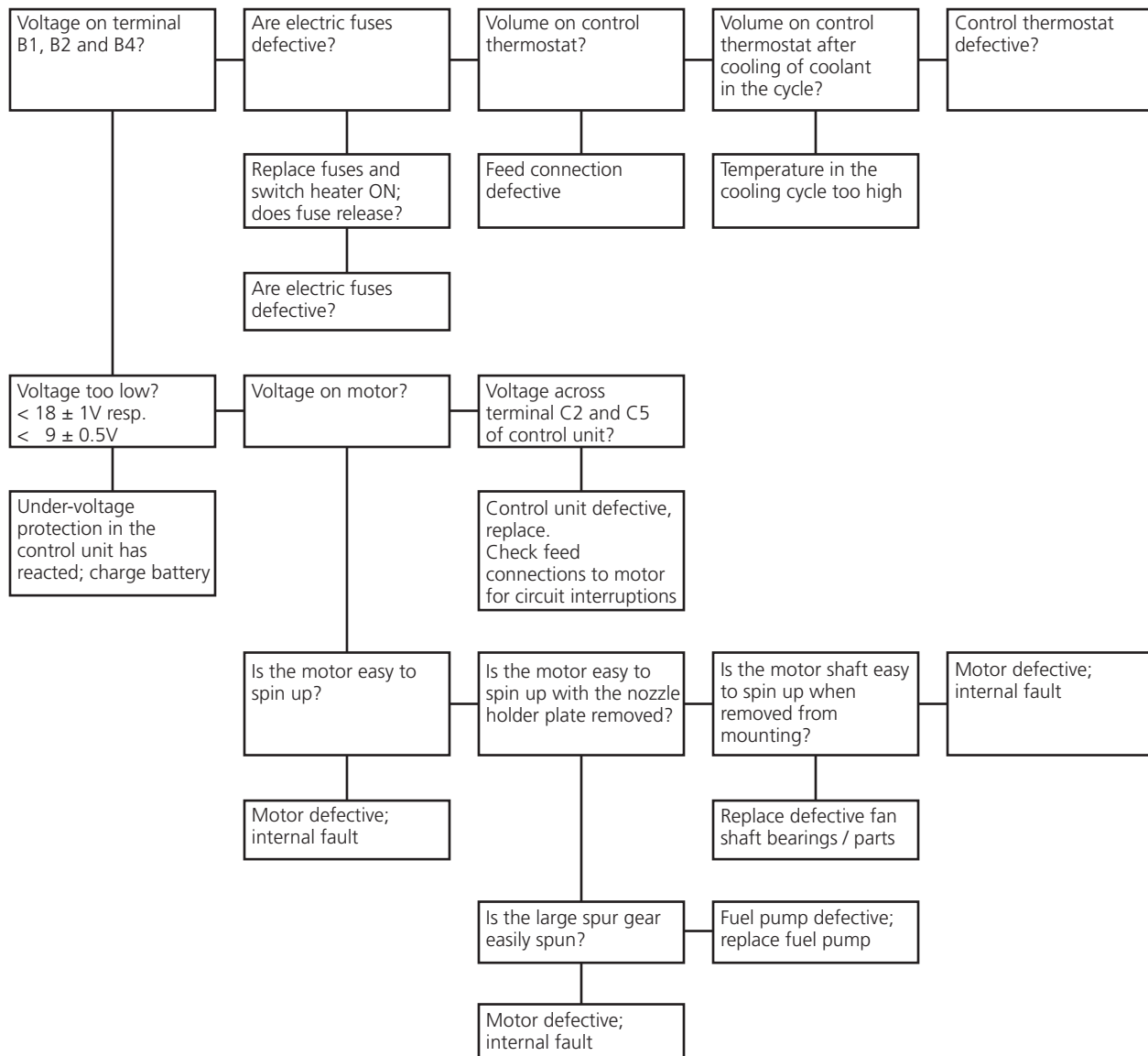
NOTE: Since the heater operates in the 68 °C (155 °F) to 75 °C (167 °F) On to Off / Off to On range, and the vehicle engine may be hot [e.g. coolant above 75 °C (167 °F)], the heater will not start until the coolant temperature is below 68 °C (155 °F). THIS IS NORMAL and does not indicate a problem.

5.3 INSTRUCTIONS FOR FAULT FINDING

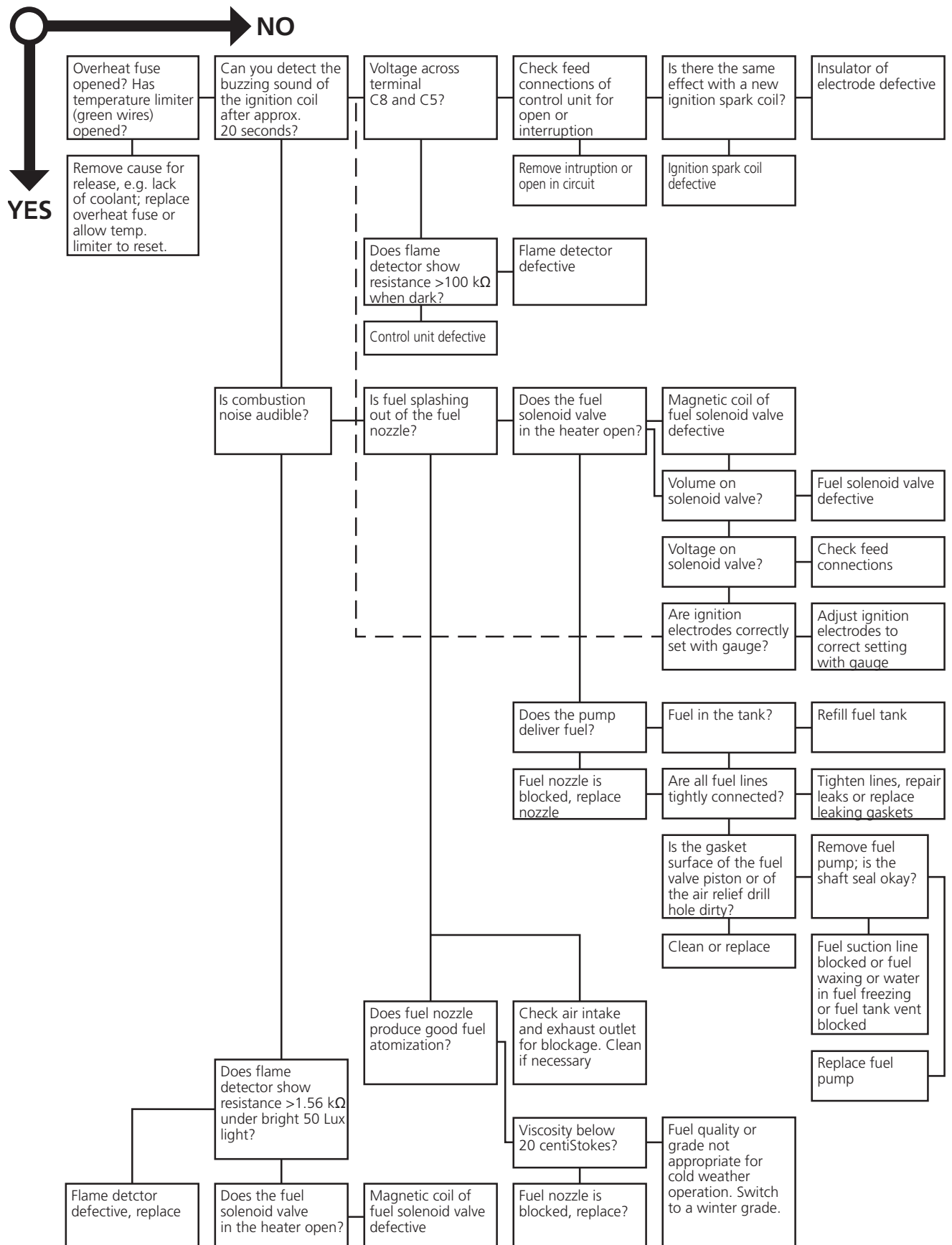
5.3.1 COMBUSTION STARTS IMMEDIATELY WHEN HEATER IS SWITCHED ON



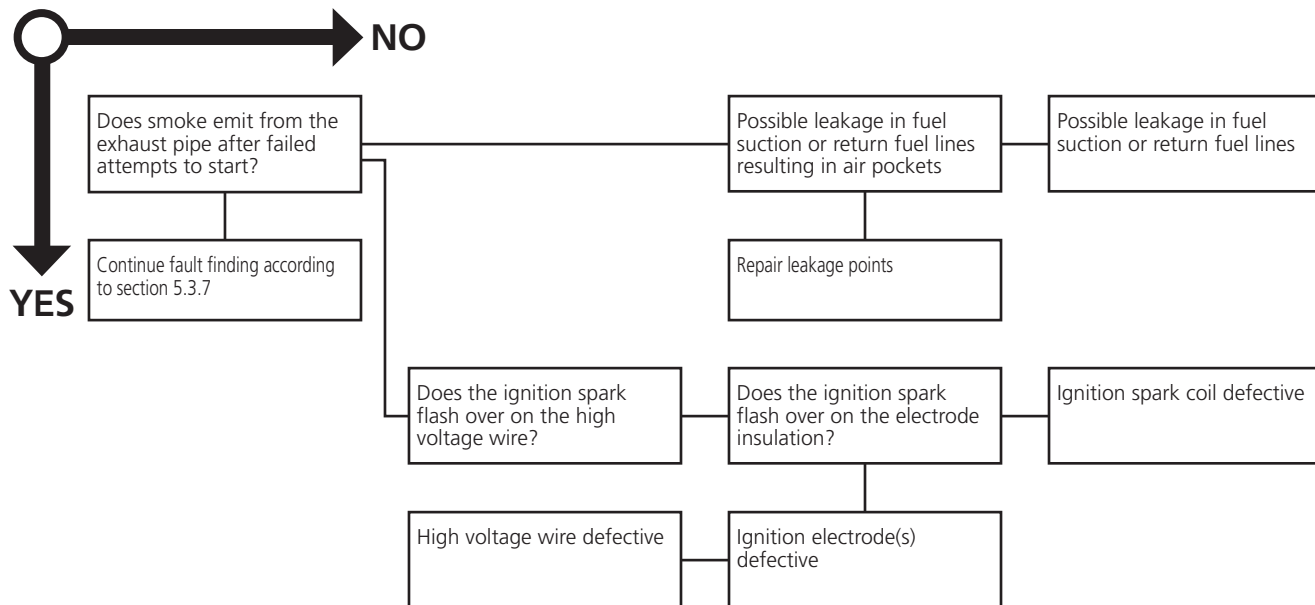
5.3.2 HEATER DOES NOT START WHEN SWITCHED ON



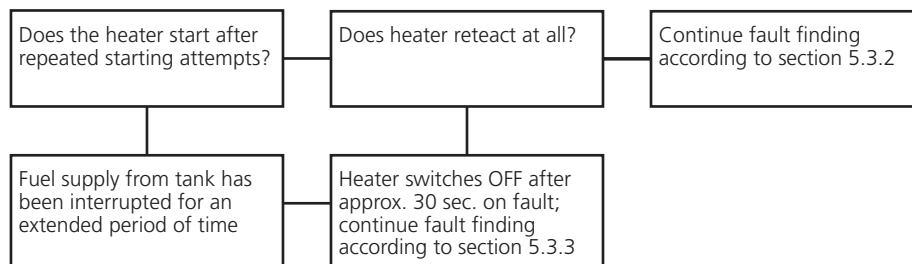
5.3.3 AFTER SWITCHING ON, THE HEATER SWITCHES OFF AFTER APPROX. 30 SECONDS ON FAULT



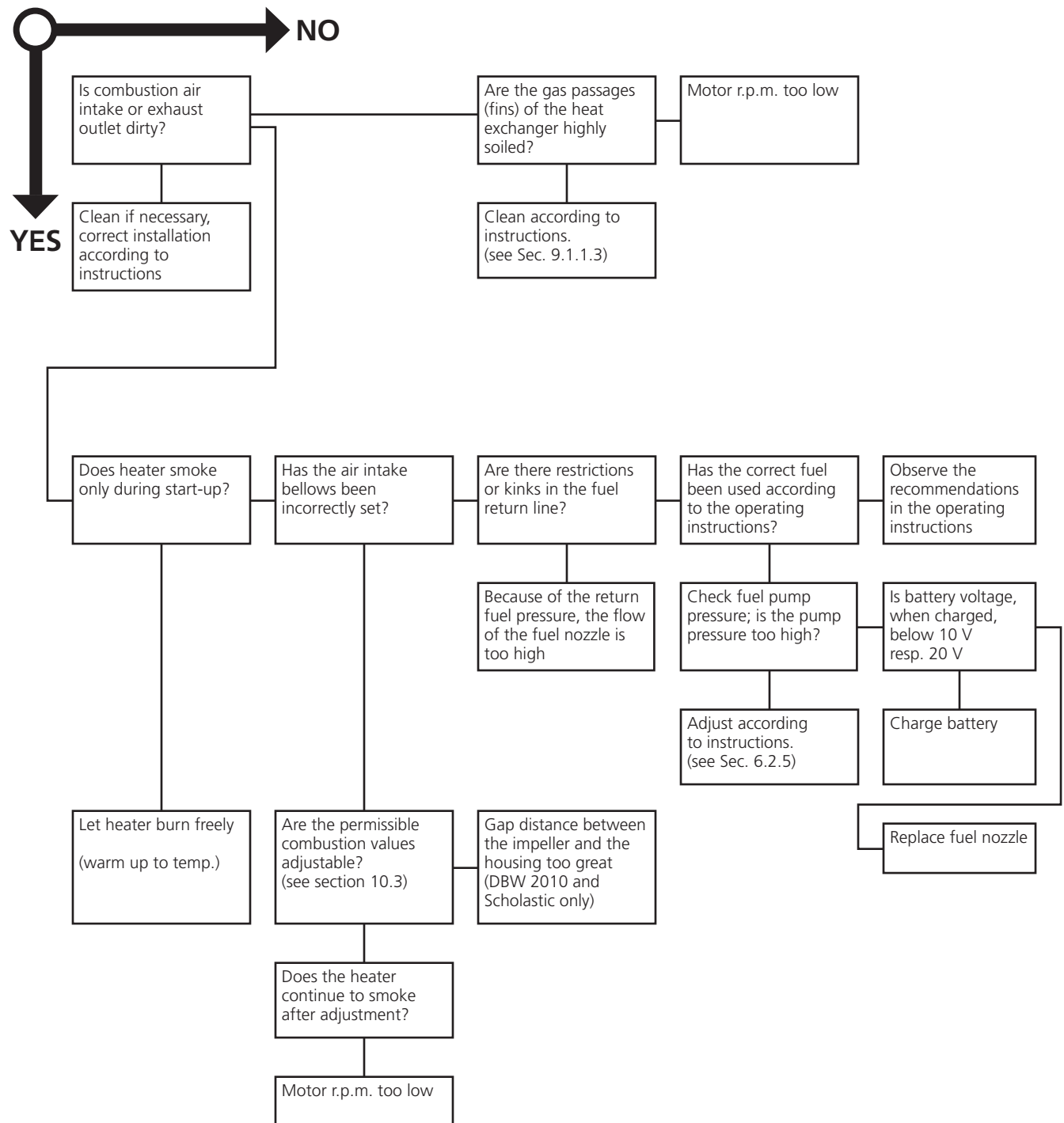
5.3.4 HEATER STARTS ONLY AFTER SEVERAL STARTING ATTEMPTS



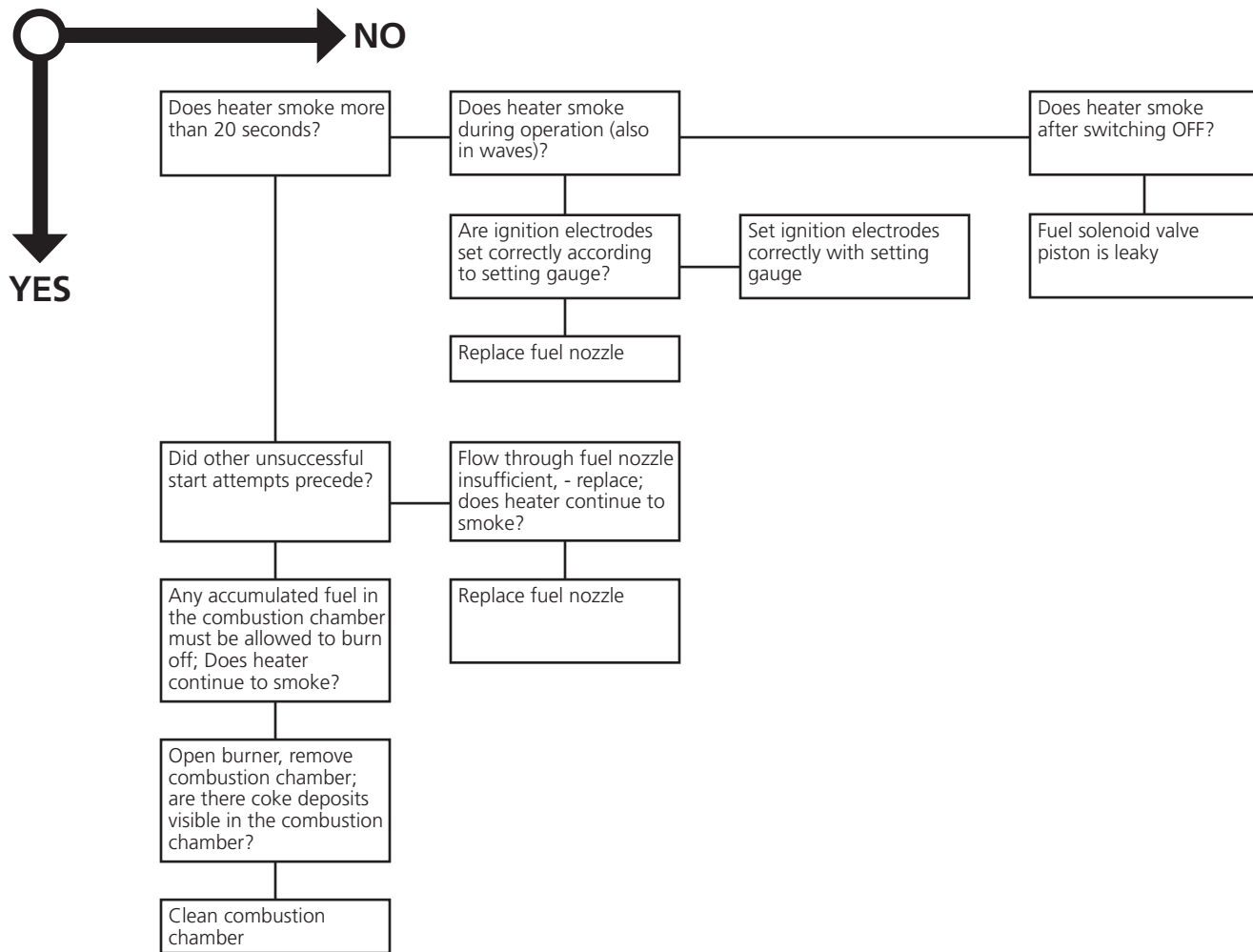
5.3.5 HEATER SWITCHES OFF BY ITSELF DURING OPERATION



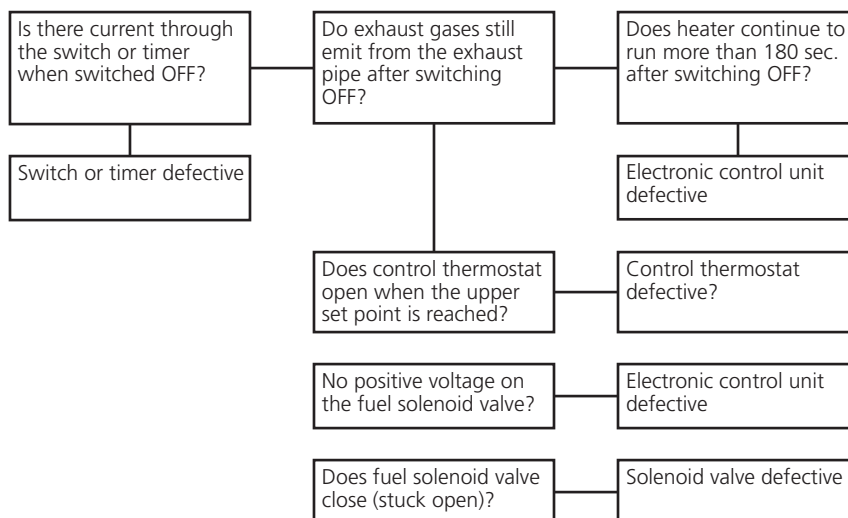
5.3.6 HEATER SMOKES



5.3.7 HEATER SMOKES



5.3.8 HEATER CANNOT BE SWITCHED OFF



6. FUNCTIONAL ADJUSTMENTS

6.1 GENERAL

This section describes the tests and adjustments on the heater in installed and removed condition to prove its serviceability.



WARNING: The heater must not be operated in closed areas like garages or workshops with no exhaust ventilation facilities.

To prevent fires do not switch heater on with burner swung open.

6.2 ADJUSTMENTS

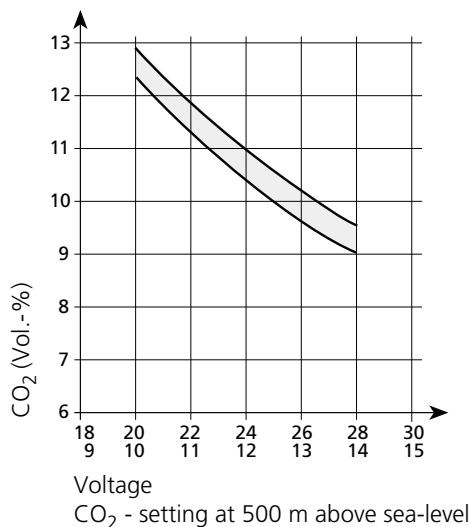
6.2.1 ADJUSTMENT OF CO₂ CONTENTS

It is allowed to change the manufacturer's setting for combustion air quantity by rotation of the setting ring.

Measurement of the CO₂ value of the exhaust gas must be performed followed by an adjustment of the combustion air quantity as required in case of:

- repairs to the burner head
- irregularities in combustion
- functional checks
- nozzle replacement

6.2.1.1 SETTING PROCEDURE



DBW 2010 (Nozzle: 0.35 gph)

DBW 2020 (Rev. ≥.33)

DBW 300

Fuel pump pressure set to 10 bar (145 psi)

- Measure control unit power supply voltage
- Operate heater for approximately 5 min.
- Measure CO₂ contents and compare with CO₂ diagram

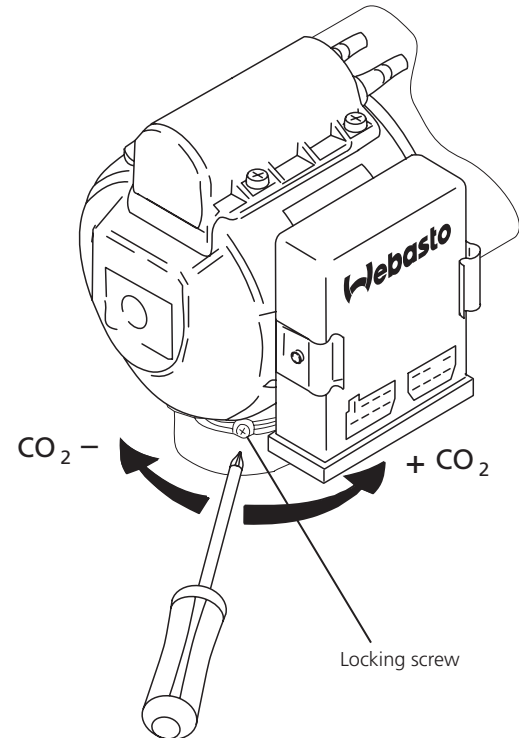


Figure 21: Combustion Air / Fuel Mixture Adjustment

- Loosen locking screw (refer to Figure above) and reposition shutter with locking screw until rated value is obtained
- Tighten locking screw with 1.0 +0.5 Nm and apply screw seal varnish to mark new position



NOTE: CO₂ setting depends on fuel (viscosity) and on geodetic altitude (0.1% per 100 m).

If proper setting cannot be obtained, proceed as follows:

- Check burner head air side for damage and replace if required
- Check fuel pump pressure and replace pump if required
- Check fuel filter and strainer in fuel pump for contamination and replace if required
- Adjust fuel pressure
- Replace fuel nozzle
- Measure burner motor speed

6.2.2 FLAME DETECTOR RESISTANCE CHECK



NOTE: The glass bulb of the flame detector and the viewing glass of the window (refer to Fig. 22) are to be cleaned if contaminated.

In case of damage, cracked glass bulb or not obtaining the rated values, replace the flame detector.

CHECK

- Swing burner head open (see Sec. 8.5.1)
- Disconnect flame detector leads
- Connect flame detector leads to ohm meter
- Cover flame detector glass bulb with your thumb
- Check resistance (rated value: < 20 kOhm)
- Uncover flame detector and expose to strong light
- Check resistance (rated value: < 200 Ohm)

ALTERNATE METHOD USING TESTER (P/N 1302691A)

- Exchange control unit with tester and swing burner head open (see Sec. 8.5.1).
- Watch “Flame Control” LED while holding your thumb over the flame detector glass bulb. LED will darken considerably.
- Remove your thumb, LED will brighten considerably. (Shine a bright light on the flame detector if in a dimly lit area.)
- The fluctuation of the LED between dim and bright will indicate the flame detector is working properly.

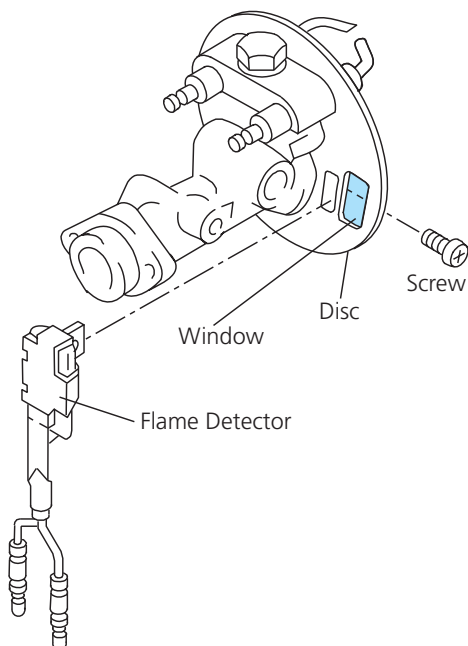


Figure 22: Flame Detector Check

6.2.3 IGNITION ELECTRODE CHECK AND SETTING



NOTE: The insulation body of the ignition electrodes must not show any damage. Damaged insulation of the electrodes requires their replacement. Setting ignition electrodes with a spacing beyond the tolerances shown in Fig. 23 may or will cause ignition failures.



NOTE: The ignition electrodes can be set with the setting gauge as shown. In addition the front edge of the setting gauge must rest against the atomizer nozzle and the tips of the electrodes in both notches.

CHECK

- Swing burner head open (see Sec. 8.5.1)
- Insulation body of the ignition electrodes for damages
- Electrode spacing with setting gauge according to Fig. 23.



CAUTION: Do not touch the nozzle drilling while measuring the electrode spacing. Keep the electrode setting gauge clean and free of contaminates.

SETTING

- Place setting gauge over nozzle as shown.
- Loosen clamp bolt until electrode can be moved with slight effort
- If necessary, electrodes can be bent slightly to conform to the setting gauge notches. Grip with pliers at the bending point only.
- Once set, snug up clamp bolt and check electrode spacing once again to confirm setting.



CAUTION: Do not over-tighten or bottom out clamp bolt. Doing so will distort the clamp causing the electrodes to spread apart.

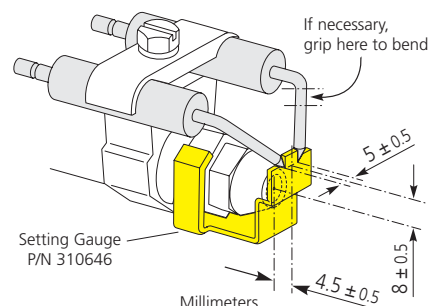


Figure 23: Setting of Ignition Electrodes

6.2.4 IGNITION COIL CHECK



WARNING: In some cases, high tension voltage of approx. 8,000 volts produced at the ignition electrodes can be fatal.



CAUTION: Do not operate the ignition coil without connection to the ignition electrodes. Doing so will cause damage to the ignition coil.

CHECK



NOTE: Take care when connecting DC voltage to the ignition coil leads. Connect positive to the black lead and negative to the brown lead.

- Swing burner head open (see Sec. 8.5.1)
- Supply DC voltage to coil leads. Positive to black lead and negative to brown lead.
- With ignition coil energized, an ignition spark will jump the ignition electrodes.

ALTERNATE METHOD USING TESTER (P/N 1302691A)

- Exchange control unit with tester and swing burner head open (see Sec. 8.5.1).
- Press and hold the ignition button to activate the ignition coil and observe spark condition.



CAUTION: Do not energize ignition coil for a period longer than 15 seconds.

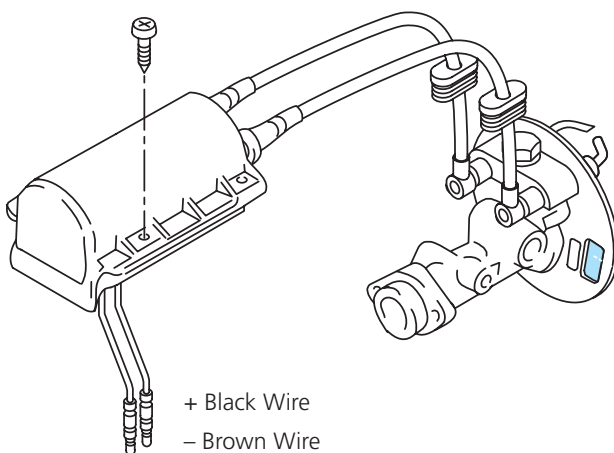


Figure 24: Ignition Coil Check

6.2.5 FUEL PUMP CHECK

A pressure gauge and the tester P/N 1302691A is required for performing this test. A suitable gauge with a range from 0 to 15 bar (0 to 220 PSI) can be procured from your authorized Webasto dealer.



NOTE: The fuel pump and the fuel hoses must be replaced every 5 years.

CHECK

- Exchange control unit with tester and swing burner head open (see Sec. 8.5.1).
- Remove nozzle.
- Screw pressure test gauge into nozzle holder.
- Switch on heater motor via tester.
- Press fuel solenoid button on tester.
- Read pressure gauge. If adjustment is required, release button and turn pump pressure screw 1/8 of a turn at a time in or out to increase or decrease pressure (see Fig. 10 for location of pressure screw).
- Repeat testing and adjustment steps until pressure is within specified range.
- Switch off heater switch on tester.
- Unscrew pressure test gauge.



CAUTION: Do not damage nozzle bore.

- Screw in nozzle and torque to 20 Nm. (15 lb-ft)

DBW 2010 w/ 0.40 gph nozzle	8 –0.5 bar (116 –7 psi)
DBW 2010 w/ 0.35 gph nozzle	10 ±0.5 bar (145 ±7 psi)
DBW 2020 & DBW 300	10 ±0.5 bar (145 ±7 psi)

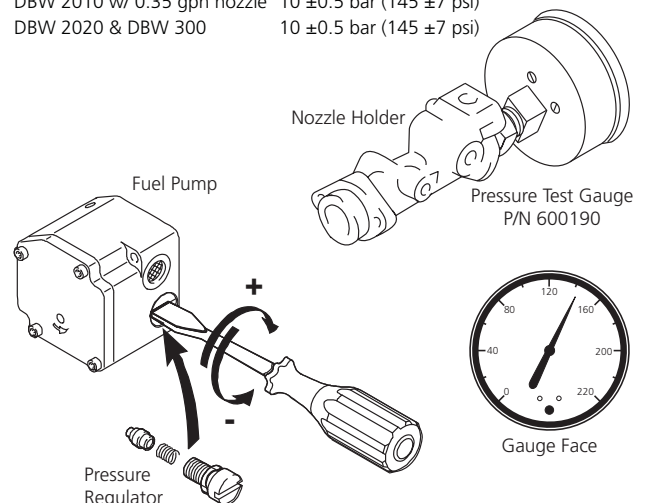


Figure 25: Fuel Pressure Check

6.2.6 FUEL SOLENOID VALVE CHECK

NOTE: A leaking solenoid valve seat or valve results in a rather long smoke emission period during run-down. In this case fuel keeps dripping through the fuel nozzle.

Short smoke emissions are normal caused by clearing the area between the solenoid valve and the nozzle bore.

CHECK

- Exchange control unit with tester P/N 1302691A and swing burner head open (see Sec. 8.5.1).
- Press fuel solenoid button on tester several times. You should hear an audible clicking sound indicating that the fuel solenoid valve is functioning. If no clicking can be heard, valve and or solenoid may require replacement (see Sec. 9.2.6).

6.2.7 NOZZLE BLOCK PRE-HEATER CHECK

At a temperature of $<0^{\circ}\text{C}$ ($<32^{\circ}\text{F}$) the heater cartridge in the nozzle block is activated. The heating period depends on the heat reflected within the combustion chamber.

Preheating is deactivated when the thermostat ambient temperature is $+8^{\circ}\text{C}$ (46°F).

Power consumption is 130 ± 13 Watts.

CHECK

- Swing burner head open (see Sec. 8.5.1)
- Disconnect electrical connector
- Connect ohmmeter to connector
- Using cooling spray to cool down thermostat
- Resistance (max. $4.5\ \Omega$).

7. CIRCUIT DIAGRAMS

7.1 DBW 2010 12 V AND 24 V - EARLY CANADIAN VERSION

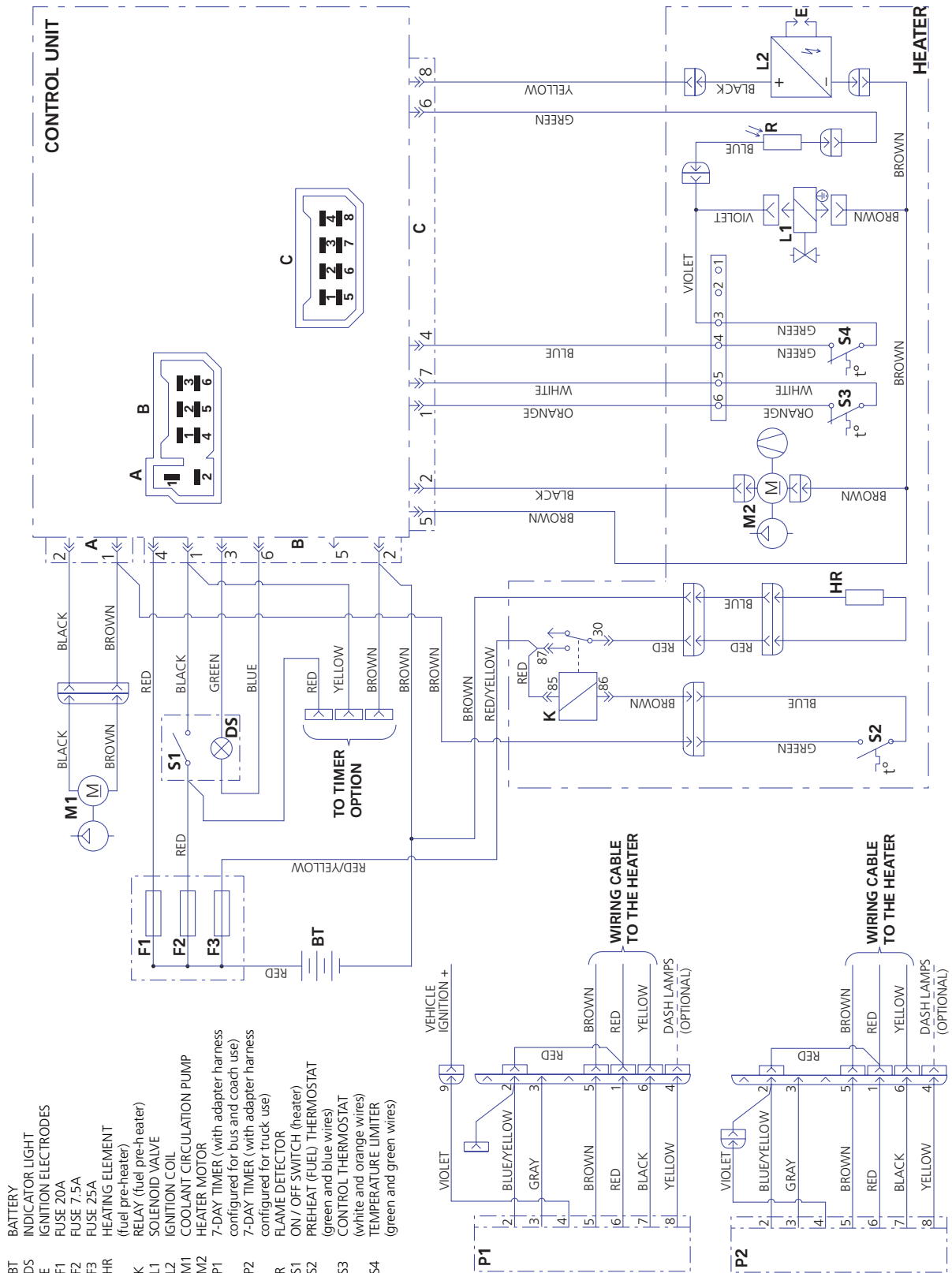


Figure 26: Schematic - DBW 2010 Early Canadian Version

7.2 DBW 2010 12 V AND 24 V - PRESENT NORTH AMERICAN VERSION

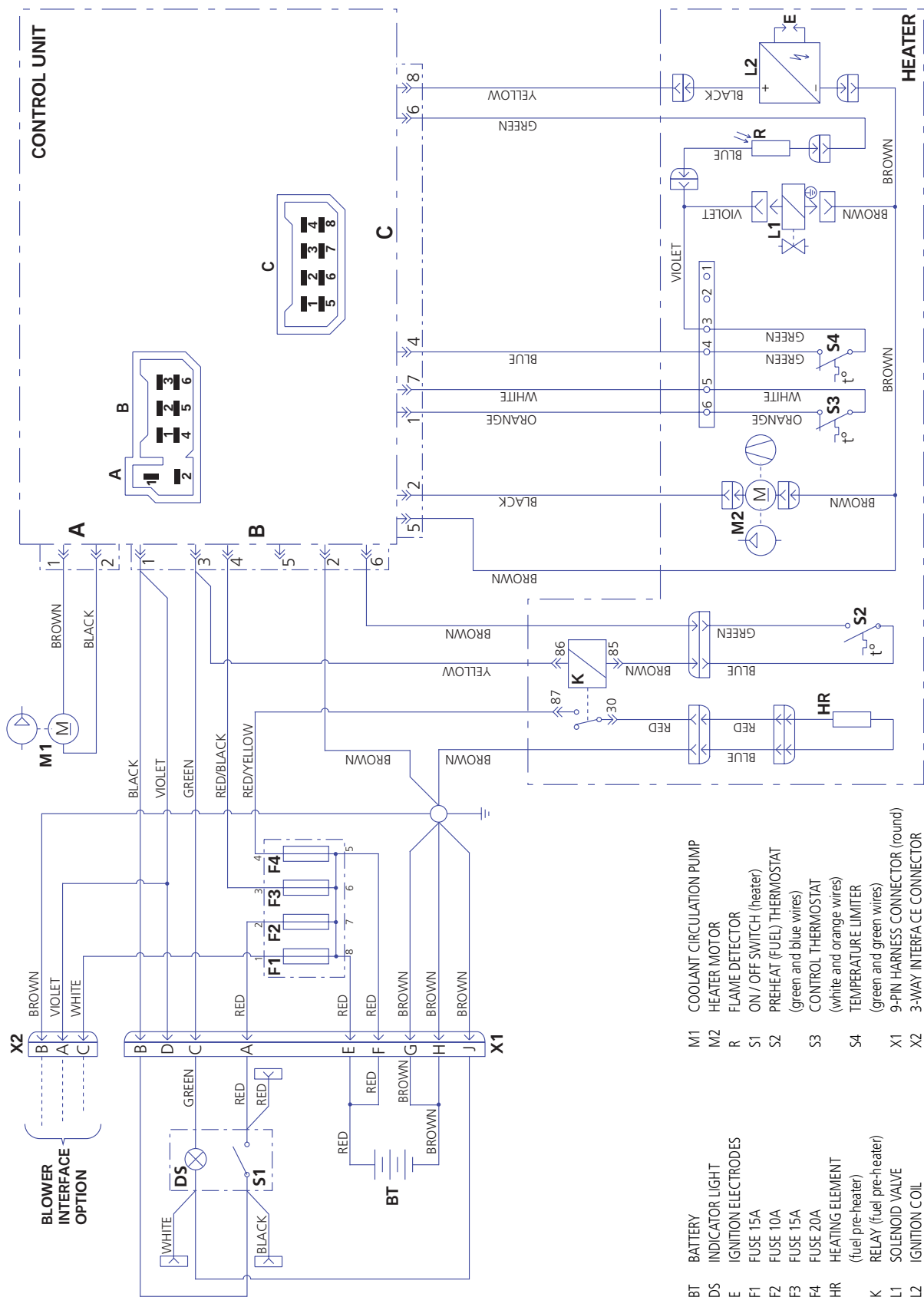


Figure 27: Schematic - DBW 2010 Present Version

7.3 DBW 2020 / 300 12 V AND 24 V - WITHOUT NOZZLE PREHEAT

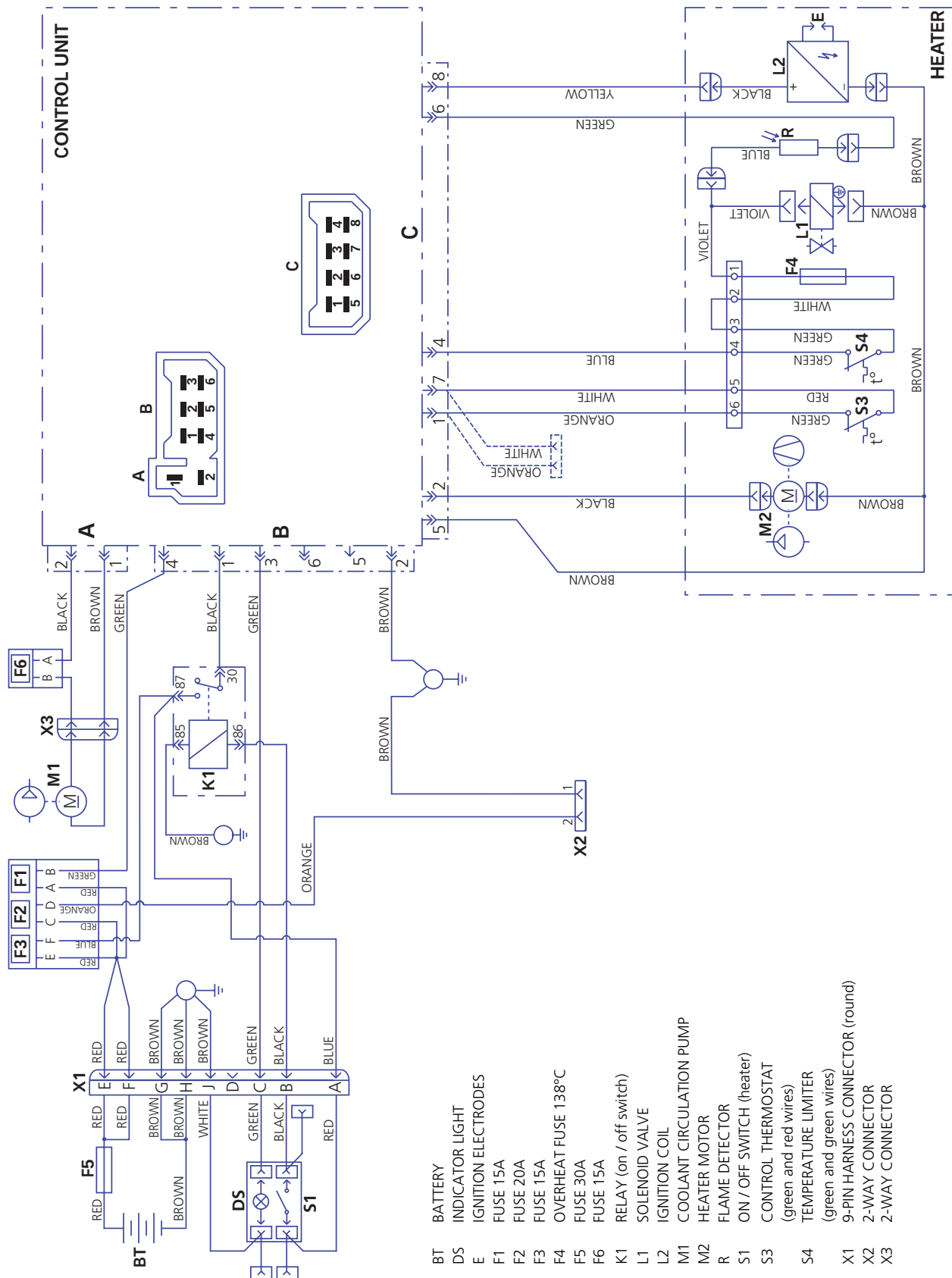


Figure 28: Schematic - DBW 2020 / 300 Without Nozzle Preheat

7.4 DBW 2020 / 300 12 V AND 24 V - WITH NOZZLE PREHEAT

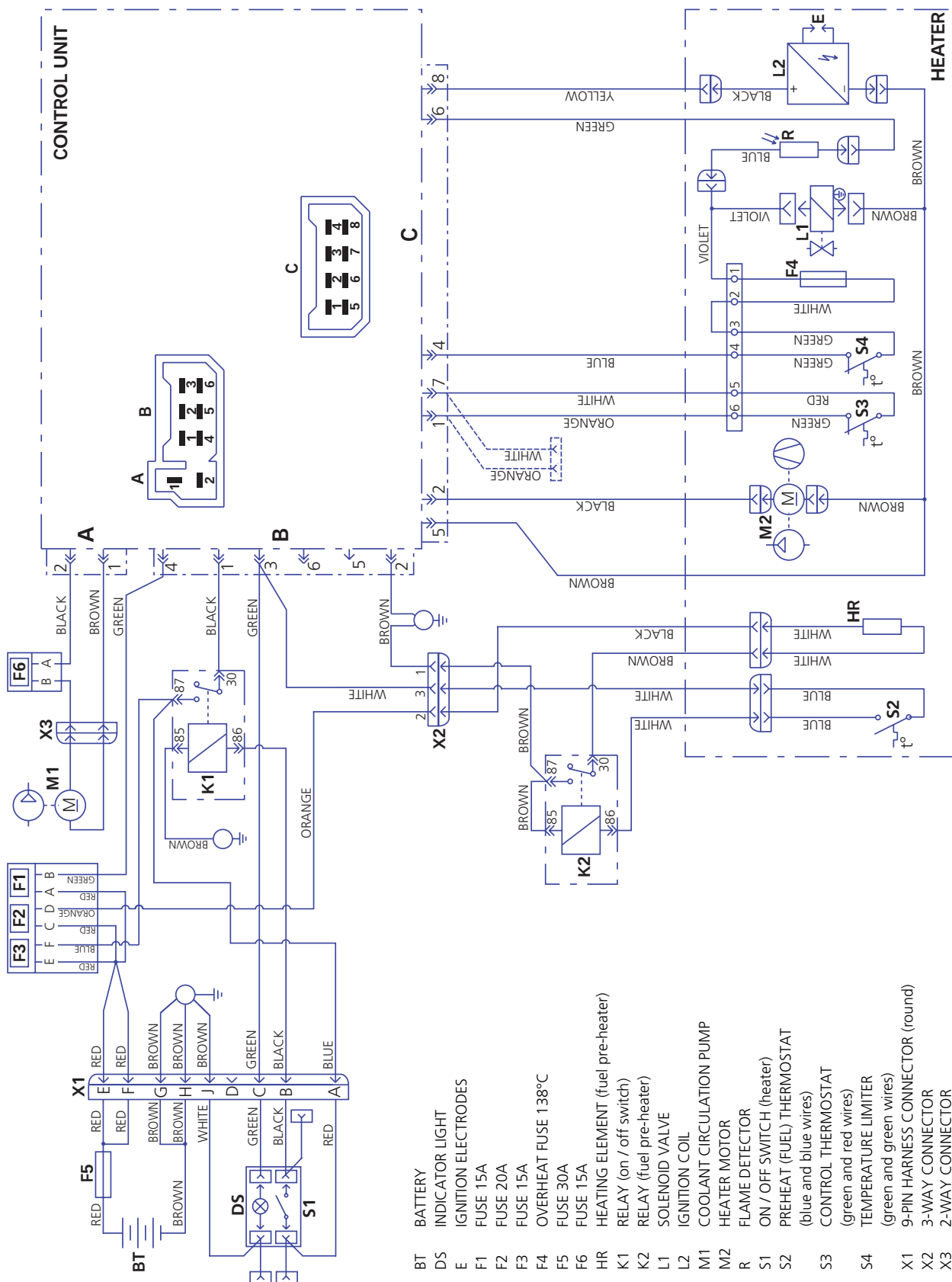


Figure 29: Schematic - DBW 2020 / 300 With Nozzle Preheat

7.5 SCHOLASTIC HEATER 12 V - WITH ON/OFF SWITCH

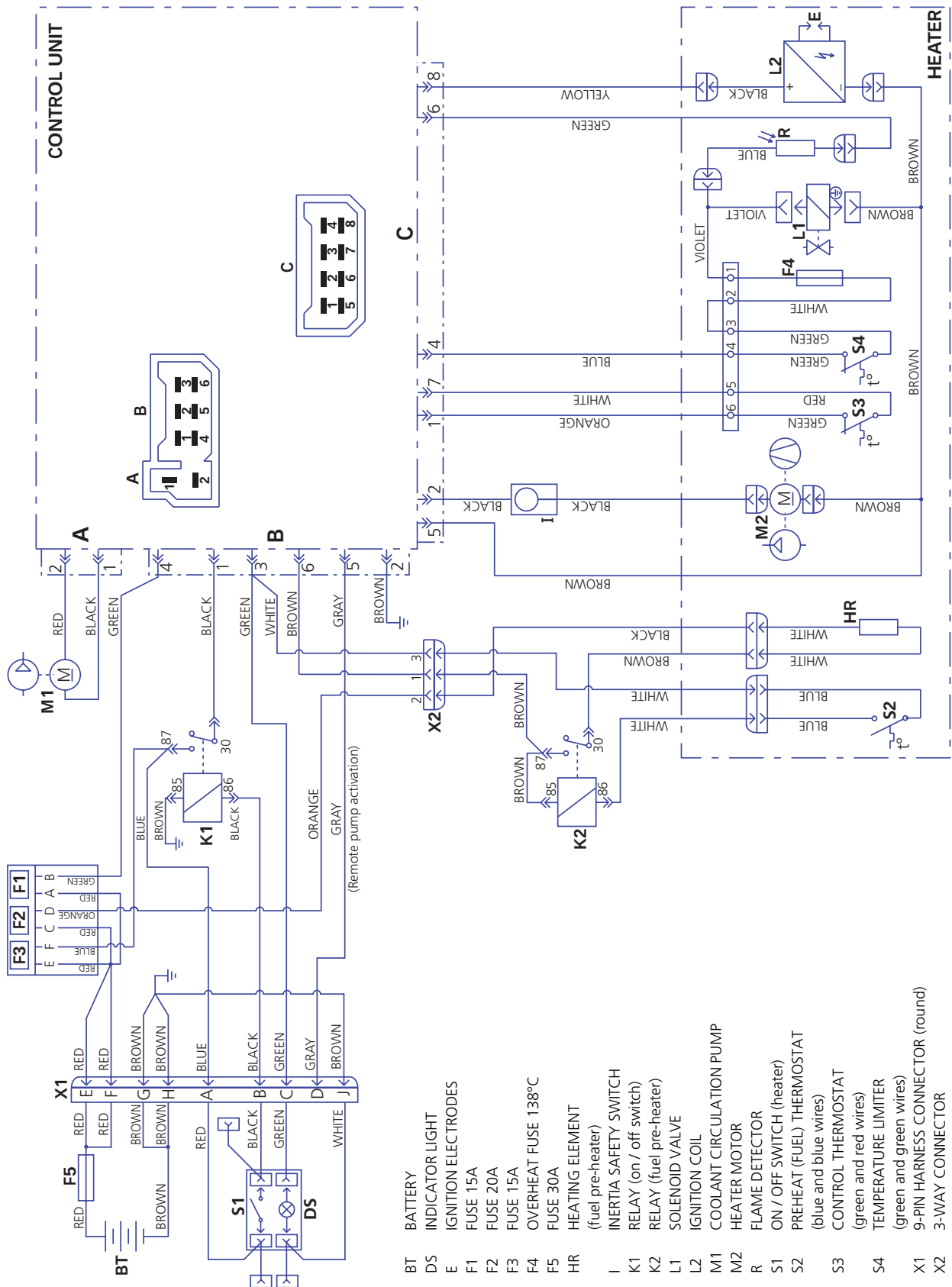


Figure 30: Schematic - Scholastic Heater™ With On/Off Switch

7.6 SCHOLASTIC HEATER 12 V - WITH 7-DAY TIMER MODEL 1529

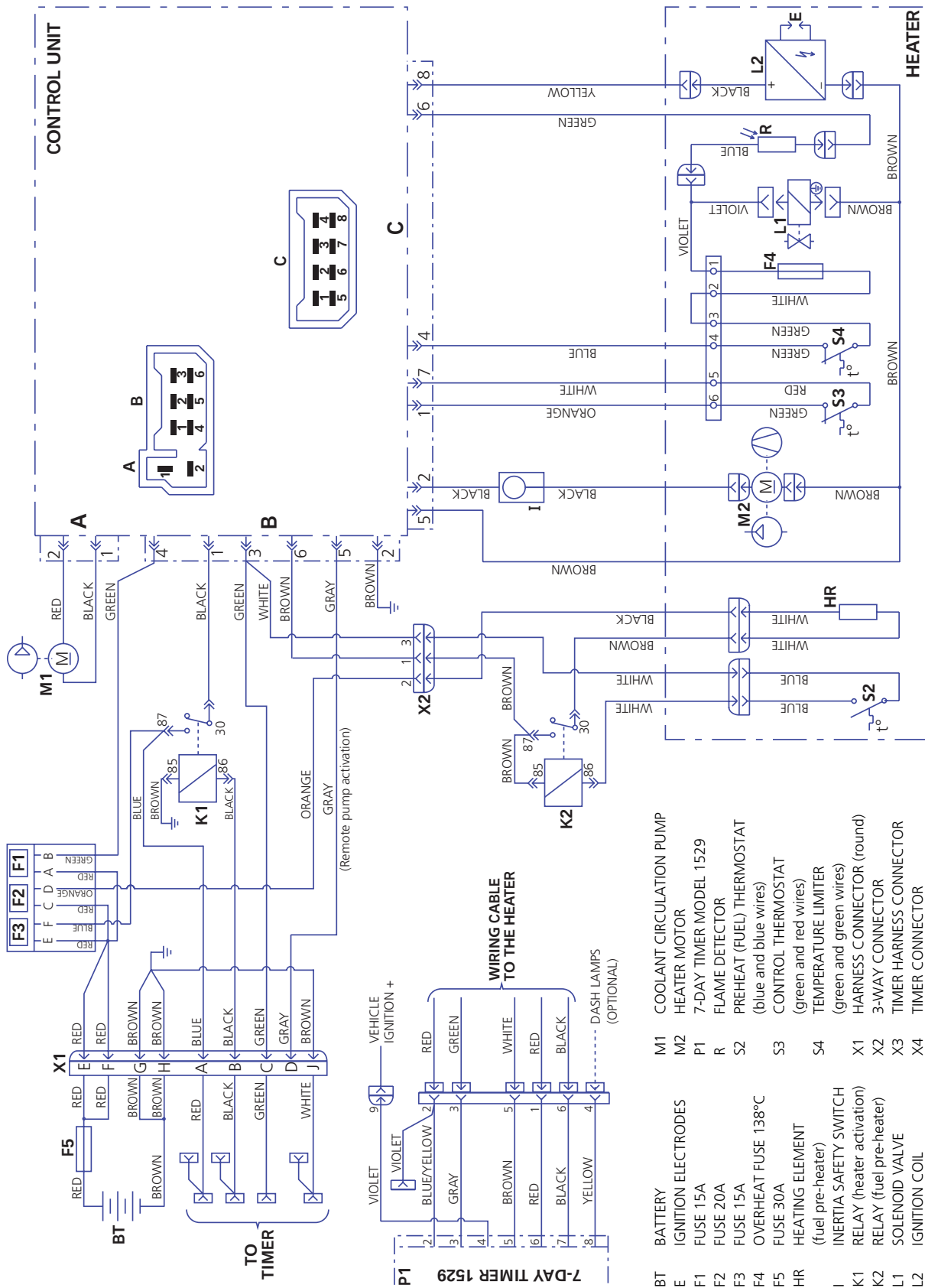


Figure 31: Schematic - Scholastic Heater™ With Digital 7-Day, 3 Program Timer Model 1529

7.7 SCHOLASTIC HEATER 12 V - WITH 7-DAY TIMER MODEL 1531

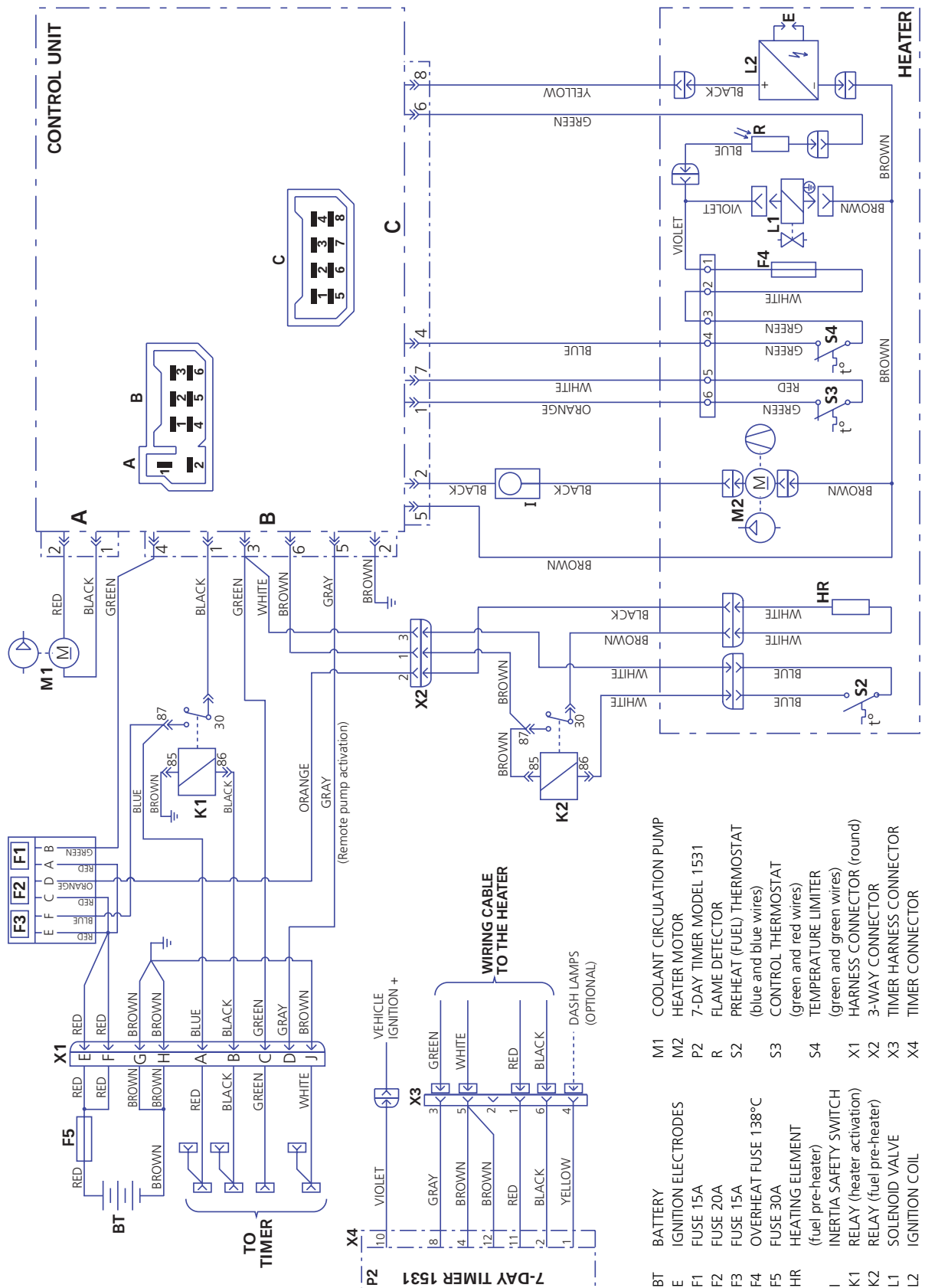


Figure 32: Schematic - Scholastic Heater™ With Digital 7-Day, 3 Program Timer Model 1531

7.8 CONTROL UNIT - IDENTIFICATION OF TERMINALS

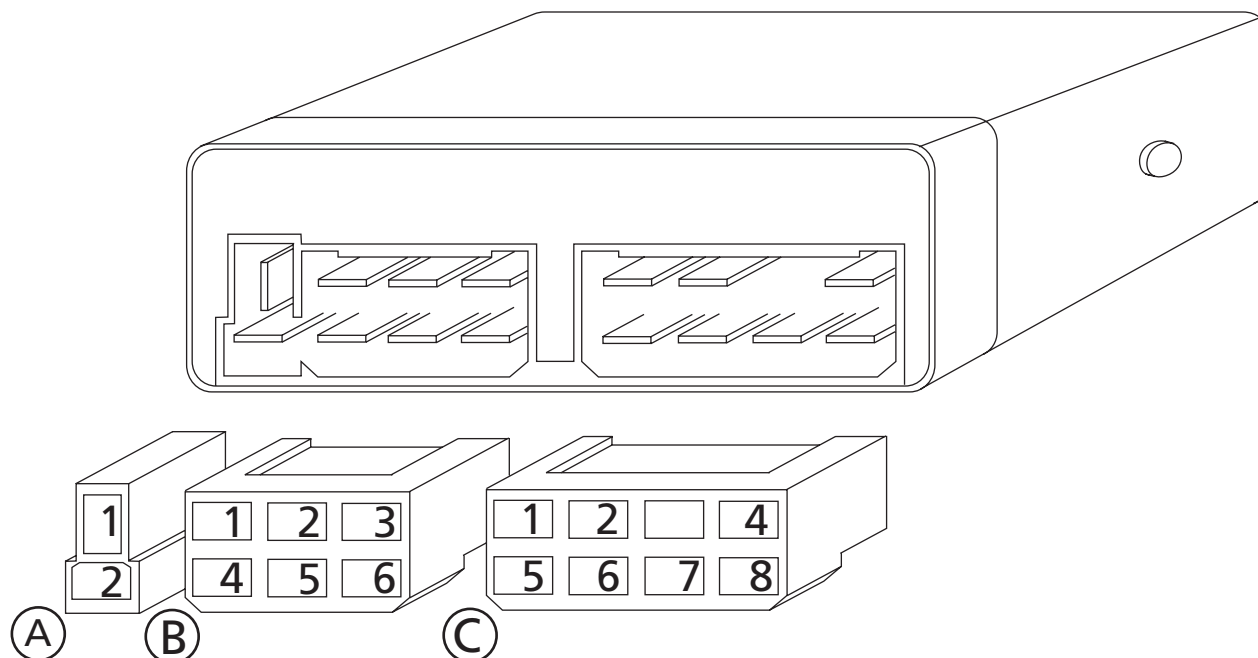


Figure 33: Control Unit - Identification of Terminals

CONNECTOR BLOCK A

- A1 (-) coolant circulating pump
- A2 (+) coolant circulating pump

CONNECTOR BLOCK B

- B1 (+) On/Off switch with low voltage protection
- B2 (-) Battery negative
- B3 (+) Control light (Operation indicator)
- B4 (+) Battery positive
- B5 (+) Optional coolant pump control input
- B6 (-) Control light (Operation indicator)

CONNECTOR BLOCK C

- C1 (+) To temperature control thermostat*
- C2 (+) To Blower motor
- C4 (+) To overheat fuse, temperature limiter and fuel solenoid valve
- C5 (-) For all heater components
- C6 (-) Flame detector
- C7 (+) From normally closed control thermostat
- C8 (+) To ignition coil

* Control thermostat with white and orange wires.
Closes at $60 \pm 5^{\circ} \text{C}$ ($140 \pm 9^{\circ} \text{F}$)
Opens at $70 \pm 3^{\circ} \text{C}$ ($158 \pm 6^{\circ} \text{F}$)

* Control thermostat with red and green wires.
Closes at $68 \pm 5^{\circ} \text{C}$ ($154 \pm 9^{\circ} \text{F}$)
Opens at $75 \pm 3^{\circ} \text{C}$ ($167 \pm 6^{\circ} \text{F}$)

8. SERVICING

8.1 GENERAL

This section describes the servicing work that can be carried out on the heater when it is installed.

8.2 HEATER SERVICING

Maintenance of the heater is necessary for proper operation and long life. Read and understand the recommendations and procedures explained in this manual before attempting to service or repair.

If you wish to carry out extensive repair work on the heater, it may be a good idea to remove it completely.

The battery must not be disconnected while the heater is running, otherwise the heater will overheat.

After working on the heating circuit replenish with a coolant mix prepared with water and anti-freeze and bleed circuit afterwards according to manufacturer's instructions.

8.3 VEHICLE SERVICING



CAUTION: A temperature of 85 °C (185 °F) must not be exceeded in the vicinity of the heater in any circumstances (for example when completing painting work on the vehicle).

If the vehicle requires electric welding, the heater must be electrically disconnected from the vehicle (both "+" and "-").

8.4 HEATER TEST RUN

The heater must not be operated, not even with the timer, in enclosed areas like garages or workshops not equipped with exhaust ventilation facilities.

8.5 MAINTENANCE



NOTE: The heater should be operated for approximately 20 minutes every 4 weeks to prevent mechanical parts seizing.

To ensure functional reliability of the heater the following maintenance must be performed:

- check combustion air inlet and exhaust outlet for contamination and clean as required.
- outside the heating season the heater should be operated with the vehicle engine cold approximately

every four weeks for 20 minutes setting the heating system to "warm". This avoids difficulties in the start-up.

- at least once a year, in case of contaminated fuel more often, the fuel filter or filter cartridge as well as the filter screen of the fuel pump must be replaced to avoid malfunctions.
- at least once a year the heat exchanger must be cleaned inside.
- in case of leakage the fuel pump and the fuel lines must be replaced immediately, otherwise every 5 years.
- the heater should be checked on regular intervals by a Webasto service agent, the latest before the beginning of the heating season.

8.5.1 BURNER HEAD OPENING AND CLOSING



WARNING: The ignition system operates with high voltage. Prior to opening the burner head the power source to the heater has to be disconnected to prevent lethal injuries.

After closing and fixing burner head, reconnect connectors in the vehicle.



NOTE: Maintenance on the heater is easy. By swinging the burner head open the following components become accessible:

- fuel pump and fuel nozzle
- solenoid valve
- ignition electrodes
- flame detector (photo eye)
- combustion chamber
- nozzle block pre-heater (if installed)

In order to obtain a convenient burner head opening angle it may be required to disconnect the electrical connections at the control unit.

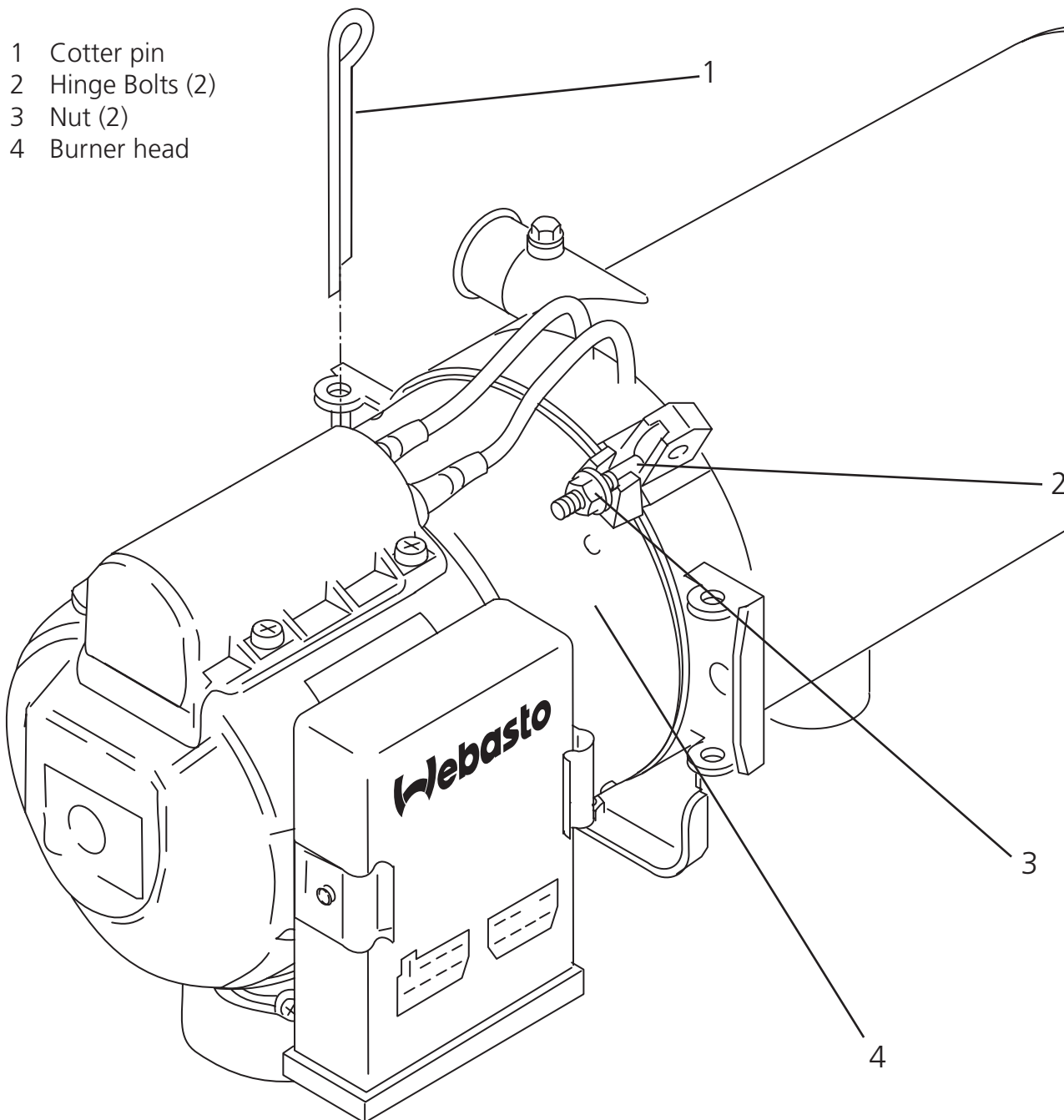
OPENING OR REMOVAL

1. Disconnect electrical connections at control unit if required.
2. Loosen nuts (item 3, Fig. 34) enough to release hinge bolts (2).
3. Swing hinge bolts (2) out of way.
4. Swing burner head (4) open.

CLOSING OR INSTALLATION

1. Swing burner head to the closed position.
2. Swing hinge bolts (2) to locking position.

3. Torque nuts (3) to:
DBW 2010: 4.0 - 4.5 Nm (35.5 - 40.0 lb-in.).
DBW 2020/300: 7.5 - 8.5 Nm (66 - 75 lb-in.).
4. Reconnect electrical connections to the control unit.



NOTE: Depending on the burner head direction of swing, the cotter pin may be located to the opposite side.
CAUTION: Always use hinge bolts to lock burner head in place.

Figure 34: Burner Head Attachment

8.6 VISUAL INSPECTIONS AND REGULATIONS FOR INSTALLATION

8.6.1 CONNECTION TO VEHICLE COOLING SYSTEM

The installation of the heater should be in a location as low as possible to ensure self-venting of the heater and circulation pump. This applies in particular for the circulation pump because it is not self-priming.

The cooling system coolant capacity must be at least 10 liters. The vehicle cooling system or the separate heating circuit must use only pressure relief valves with an opening pressure of at least 0.4 bar and of max. 2.0 bar.

It is a basic requirement to use the coolant hoses supplied by Webasto, otherwise the hoses must at least meet the specifications of DIN 73411. The hoses have to be installed free of kinks and for proper venting in an inclination. Hose connections must be secured against slippage with hose clamps.



NOTE: The specified tightening torques of the hose clamps used must be complied with.

Prior to the heater's first operation or after replacement of the coolant, attention must be paid to carefully bleed the cooling system. Heater and lines must be installed so that static venting is guaranteed.

Improper venting may cause malfunctions by overheating in equipment operation.

Proper venting may be identified by a circulation pump almost noiseless in operation.

8.6.2 CONNECTION TO VEHICLE FUEL SYSTEM

Fuel is tapped from the fuel reservoir of the vehicle or from a separate fuel tank.

8.6.2.1 FUEL LINES

In order to avoid air from being captured in fuel lines, they should only be installed with an incline. The fuel line joints are to be secured against slipping with hose clamps should no screwed mechanical unions be in use.

Should fuel hoses be installed always use the hoses supplied or offered by Webasto. If other hoses are used they must at least meet the specifications of DIN73379-1C; type 3. Fuel hoses must not be kinked or twisted and must be secured with clamps every 25 cm (10 in.).

Also, fuel lines may be used consisting of materials standard in the manufacturing of vehicles, e.g. steel or plastic lines made of unhardened, light and temperature stabilized PA11 or PA12 (e.g. Mecanyl RWTL) according

to DIN 73378 observing the applicable jointing instructions.

Basic rules for the routing of fuel lines are:

- Protect against undue temperatures.



WARNING: In overheat condition the heater outer shell may reach the flash point temperature of Diesel fuel!

- Protect lines from stone strikes and debris that could damage them and result in leakage.
- **Dripping or evaporating fuel must not be allowed to accumulate or ignite on hot components or electrical equipment.**

The installation of an additional fuel pump is not allowed.

Fuel lines permissible dimensions:

- Inner diameter for suction and return line: 6 mm (except Scholastic Heater™).
- Scholastic Heater™ inner diameter for suction line: 3/16 inches.
- Maximum permissible length for each suction and return line: 10 m
- Maximum permissible suction height: 2 m
- Maximum permissible priming pressure: 0.3 bar for suction and return line.

8.6.2.2 FUEL FILTER

A fuel filter supplied as deliverable item or cleared for use by Webasto is to be fitted.

Installation position possibly vertical with horizontal direction of flow. To avoid operating malfunctions replace filter or filter cartridge once a year or more often if fuel is contaminated.

8.6.3 COMBUSTION AIR SUPPLY



CAUTION: Observe official regulations concerning the installation (see 1.6).

Combustion air must under no circumstances be extracted from rooms with persons. The combustion air inlet must not point towards the forward direction of motion.

It must be located so that no clogging by contamination, impact of snow, or intake of splash water is to be expected.

The combustion air intake and exhaust outlet is to be located so that no air pressure difference builds up in any operating condition of the vehicle.

The combustion air inlet must be located so that no exhaust fumes can enter.

If the heater is located near the fuel tank in a common installation compartment, combustion air must be taken in from and the exhaust routed to the exterior. The feed-through holes must be sealed against splash water.

If the heater is located in a closed installation box, a vent port is required:

- **DBW 2010:** 20 cm² (3.1 inch²)
- **DBW 2020/300:** 30 cm² (4.65 inch²)

If the temperature in the installation box exceeds the permitted ambient temperature of the heater (see Technical Data), the vent port must be enlarged.

8.6.4 EXHAUST LINE



CAUTION: Observe official regulations concerning the installation (see 1.6).

The exhaust pipe outlet opening must not point in the direction of motion.

The exhaust pipe outlet opening must be located so as not to expect clogging by snow or mud.

The combustion air intake and exhaust outlet is to be located so that no air pressure difference builds up in any operating condition of the vehicle.

Rigid pipes made of unalloyed or alloyed steel with a minimum wall thickness of 1.0 mm have to be used as exhaust line or flexible pipes made of alloyed steel only.

The exhaust pipe is secured to the air heater e.g. with a clamp.

- Permissible exhaust line dimensions:
DBW 2010 = 38 mm (1.5 in.)
DBW 2020 up to .32 / DBW 300 up to .15 = 80 mm (3.15 in.)
DBW 2020 from .33 / DBW 300 from .165 = 70 mm (2.75 in.)
- max. length: 5 m (16 ft)
- max. bend: 270°

As an alternative an exhaust deflector can be installed when cleared by Webasto.

8.7 REMOVAL AND INSTALLATION



CAUTION: In installed condition only the following disassembly or removal procedures are permitted should enough space for removal allow such action:

- replacement of temperature limiter
- replacement of temperature control thermostat
- replacement of overheat fuse
- replacement of burner
- replacement of fuel atomizing nozzle
- replacement of nozzle preheat cartridge
- replacement of nozzle preheat thermostat
- replacement of ignition coil
- replacement of flame detector
- replacement of combustion chamber
- replacement of control unit

8.7.1 HEATER, REMOVAL AND INSTALLATION

8.7.1.1 REMOVAL

1. Disconnect connectors of cable harness in vehicle and of circulation pump.
2. Disconnect combustion air intake on heater if equipped.
3. Loosen clamp on exhaust outlet.
4. Loosen fuel supply and return line connections and fit dummy plugs. Close water valves as applicable.
5. Loosen hose clamps on coolant hoses, disconnect hoses and fit dummy plugs.
6. Remove 3 screws and washers or 4 screws and washers of heater base.
7. Remove heater.

8.7.1.2 INSTALLATION

1. Locate heater for installation and secure with 3 screws and washers or 4 screws and washers.
2. Secure line on exhaust outlet using clamp.
3. Slide on coolant hoses and fasten with hose clamps. Torque clamps with 1.5 Nm. Open water valves.
4. Connect fuel supply and return lines and tighten connections or screw tight with banjo bolt and new gaskets.
5. Secure combustion air inlet line on heater if applicable.
6. Connect electrical connectors of cable harness in vehicle and to circulation pump.
7. Bleed fuel supply system.
8. Bleed coolant circuit.

8.7.2 TEMPERATURE LIMITER, REPLACEMENT



NOTE: The replacement procedure for the temperature limiter is identical with the heater installed or removed.
Perform replacement in accordance with 9.2.3.

8.7.3 TEMPERATURE THERMOSTAT, REPLACEMENT



NOTE: The replacement procedure for the temperature control thermostat is identical with the heater installed or removed.
Perform replacement in accordance with 9.2.2.

8.7.4 OVERHEAT FUSE, REPLACEMENT



NOTE: The replacement procedure for the overheat fuse is identical with the heater installed or removed.
Perform replacement in accordance with 9.2.1.

8.7.5 BURNER HEAD, REPLACEMENT



NOTE: The replacement procedure for the burner head is identical with the heater installed or removed.
Perform replacement in accordance with 9.2.5.



WARNING: The ignition system operates on high voltage. Prior to replacement of burner, disconnect electrical connectors of cable harness in vehicle to avoid lethal accidents.

8.7.6 IGNITION COIL, REPLACEMENT



NOTE: The replacement procedure for the ignition coil is identical with the heater installed or removed.
Perform replacement in accordance with 9.2.11.



WARNING: The ignition system operates on high voltage. Prior to replacement of the ignition coil and related components, disconnect electrical connectors of cable harness in vehicle to avoid lethal accidents.

8.7.7 FLAME DETECTOR (PHOTO EYE), REPLACEMENT



NOTE: The replacement procedure for the flame detector is identical with the heater installed or removed.
Perform replacement in accordance with 9.2.9.



WARNING: The igniter box operates on high voltage. Prior to replacement of flame detector, disconnect electrical connectors of cable harness in vehicle to avoid lethal accidents.

8.7.8 COMBUSTION CHAMBER, REPLACEMENT



NOTE: The replacement procedure for the combustion chamber is identical with the heater installed or removed.
Perform replacement in accordance with 9.2.17.



WARNING: The heater operates on high voltage. Prior to replacement of combustion chamber, disconnect electrical connectors of cable harness in vehicle to avoid lethal accidents.

8.8 FIRST OPERATION

After heater installation the coolant circuit and the fuel supply system must be thoroughly bled observing the vehicle manufacturer's instructions. During test runs all coolant and fuel line connections have to be checked for security and no leakage. Should the heater in operation enter a fault condition, perform troubleshooting (refer to Section 5).

8.8.1 WATER CIRCUIT, BLEEDING



NOTE: Bleeding must always be performed in accordance with manufacturer's instructions. For bleeding the circulation pump must not be switched on.

Set vehicles own heating system to "warm" and replenish coolant which must consist of at least 20% anti-freeze (glycol base for protection against corrosion). When using pure water there will be no protection against corrosion and due to the lower boiling point of the water when overheating loss of cooling water may result requiring continuous replenishment. Additives in the coolant must not affect metals, plastics or rubber and leave no deposits.

Then operate engine at increased idle until radiator thermostat opens. Shut down engine, check coolant level and replenish as required.

Switch on heater and vehicle heating fan with engine shut down. After a certain cool-down period the heater must automatically switch on and control to off. In case of no restart attempt the temperature limiter on the

heater has responded because the heater has not been bled properly.

Reset temperature limiter (allow temperature limiter to cool, self resetting) and repeat complete bleeding procedure.



NOTE: *The heater may be equipped with an automatically resetting temperature limiter. The manual reset is not necessary.*

8.8.2 FUEL SUPPLY SYSTEM, BLEEDING

When switching the heater on the fuel pump pulls fuel from the fuel tank to prime the complete fuel supply system.

Should no combustion be achieved with the first start attempt, switch the heater off and on again.

9. REPAIR

9.1 GENERAL INFORMATION

This section describes the repairs that may be performed on the heaters DBW 2010, 2020 and 300 when removed. Any further disassembly will void the warranty.

For re-assembly only components of the proper service part kits are to be used.



WARNING: *The ignition system operates on high voltage. Prior to replacement disconnect connectors of cable harness in vehicle to avoid lethal accidents.*

The following components may also be replaced with the heater installed unless restricted space prevents access:

- replacement of temperature limiter
- replacement of temperature control thermostat
- replacement of overheat fuse
- replacement of burner
- replacement of fuel atomizing nozzle
- replacement of nozzle preheat cartridge
- replacement of nozzle preheat thermostat
- replacement of ignition coil
- replacement of flame detector
- replacement of combustion chamber
- replacement of control unit

9.1.1 WORK ON COMPONENTS AFTER DISASSEMBLY



CAUTION: *All gaskets located between disassembled components must always be discarded and replaced with new gaskets.*

9.1.1.1 VISUAL INSPECTION, GENERAL

- Examine all components for damages (cracks, deformation, wear, etc.) and replace as necessary.
- Examine connectors and wiring for corrosion, loose contacts, wrong crimping, etc. and repair as necessary.
- Check terminals for corrosion and contacts for security. Repair as required.

9.1.1.2 COMBUSTION CHAMBER, VISUAL INSPECTION

- Check swirl ring for security.
- Check swirl ring for melting and deformation (DBW 2010).
- Inspect combustion chamber for oxidizing and coke deposits and remove as required.
- Check welding seam for cracks.



NOTE: *Longitudinal cracks up to 38 mm (1.5 in.) are allowed.*

9.1.1.3 HEAT EXCHANGER, VISUAL INSPECTION

- Inspect exhaust ducting in heat exchanger for sooting, deposits, damage and corrosion.



NOTE: *Deposits are to be removed with water jet and brush.*

- Inspect heat exchanger for exterior damage, deformation, etc.



NOTE: *Heavy deformation may cause restricted flow of coolant.*



CAUTION: *When replacing the combustion chamber on heaters installed vertically, remove deposits in heat exchanger using a suitable tool.*

9.1.1.4 COMBUSTION AIR FAN WHEEL, VISUAL INSPECTION

- The fan wheel has to be checked for contamination, traces of grinding and cracks.

DBW 2010 ONLY:

The clearance between the blower wheel and blower case must be measured (measurable with a feeler gauge) at the narrowest point. Clearance = 0.15/-0.05 mm.

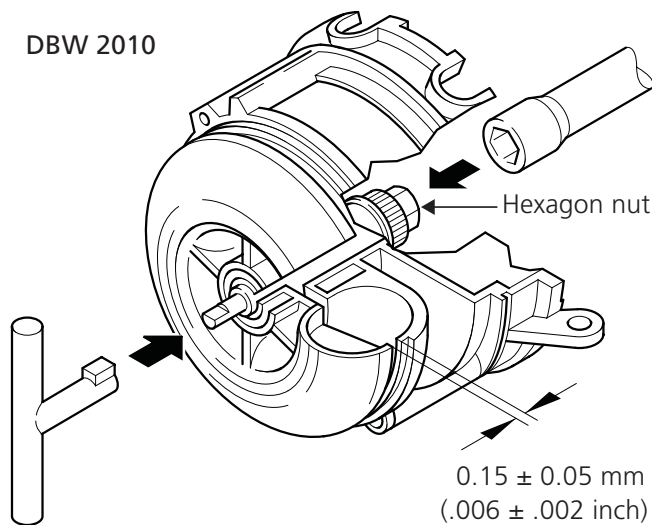


Figure 35: Clearance Adjustment - DBW 2010 Fan

DBW 2020/300 ONLY:

- The hub of the impeller has to be checked for cracks and the cover disc (back wall) as to its stability.

9.2 DISASSEMBLY AND ASSEMBLY

9.2.1 OVERHEAT FUSE, REPLACEMENT

9.2.1.1 REMOVAL

1. Disconnect electrical connection to overheat fuse at connector block.
2. Turn counterclockwise to remove overheat fuse (item1, Fig. 36) from dry-well.

9.2.1.2 INSTALLATION

1. Turn overheat fuse clockwise into dry-well until snug but not tight.
2. Turn out 1/2 turn.
3. Plug connector into connector block.



NOTE: Observe electrical wiring color coding when making connections.

9.2.2 TEMPERATURE CONTROL THERMOSTAT, REPLACEMENT

9.2.2.1 REMOVAL

1. Disconnect electrical connection to temperature control thermostat at connector block.
2. Turn counterclockwise to remove temperature control thermostat (item 2, Fig. 36).

9.2.2.2 INSTALLATION

1. Turn temperature control thermostat clockwise into bracket until snug.
2. Plug connector into connector block.



Observe electrical wiring color coding when making connections.

9.2.3 TEMPERATURE LIMITER, REPLACEMENT**9.2.3.1 REMOVAL**

1. Disconnect electrical connection to temperature limiter at connector block.
2. Turn counterclockwise to remove temperature limiter (item 3, Fig. 36).

9.2.3.2 INSTALLATION

1. Turn temperature limiter clockwise into bracket until snug.
2. Plug connector into connector block.



NOTE: Observe electrical wiring color coding when making connections.

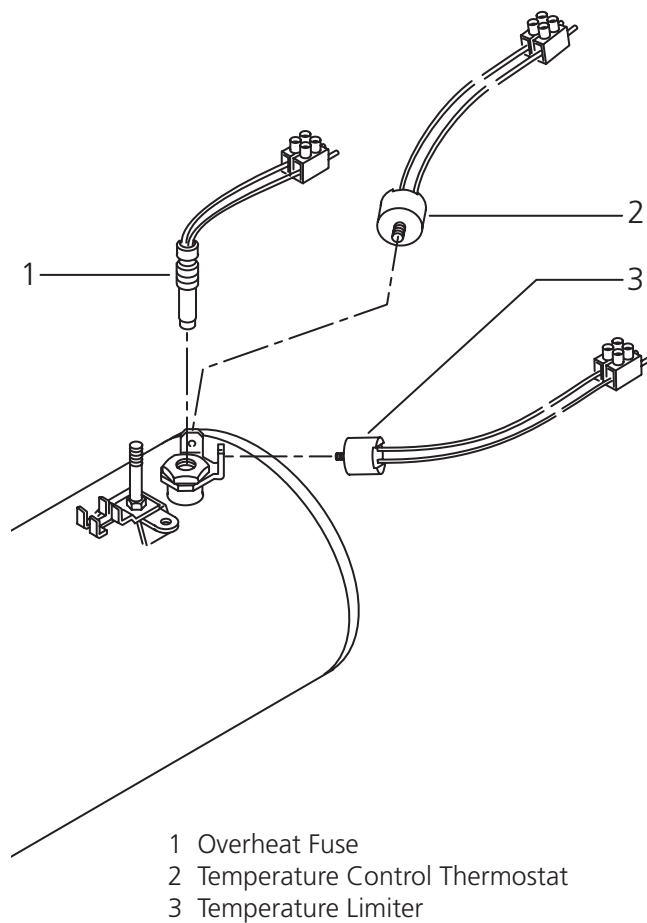


Figure 36: Temperature Control Elements

9.2.4 CONTROL UNIT, REPLACEMENT**9.2.4.1 REMOVAL**

1. Disconnect all electrical connections from control unit.
2. Carefully withdraw control unit from holding clip or slide out with holding clip (Fig. 37).

9.2.4.2 INSTALLATION

1. Carefully push control unit (into holding clip or slide into position with clip attached (Fig. 37).
2. Restore electrical connections.

9.2.5 BURNER, REPLACEMENT**9.2.5.1 REMOVAL**

1. Disconnect electrical connections on burner and loosen fuel lines.
2. Loosen two nuts (item 3, Fig. 38) until hinge bolts are free.
3. Swing hinge bolts (2) open and remove cotter pin (1).
4. Remove burner (4).

9.2.5.2 INSTALLATION

1. Position burner (4, Fig. 38) for installation, swing hinge bolts (2) closed and secure temporarily using hinge bolts (2).
2. Insert cotter pin (1) according to the intended opening swing direction.
3. Tighten nuts:
DBW 2010 = 5 - 6 Nm (44 - 53 lb-in.).
DBW 2020/300 = 7.5 - 8.5 Nm (66 - 75 lb-in.).
4. Connect fuel lines.
5. Restore electrical connections.

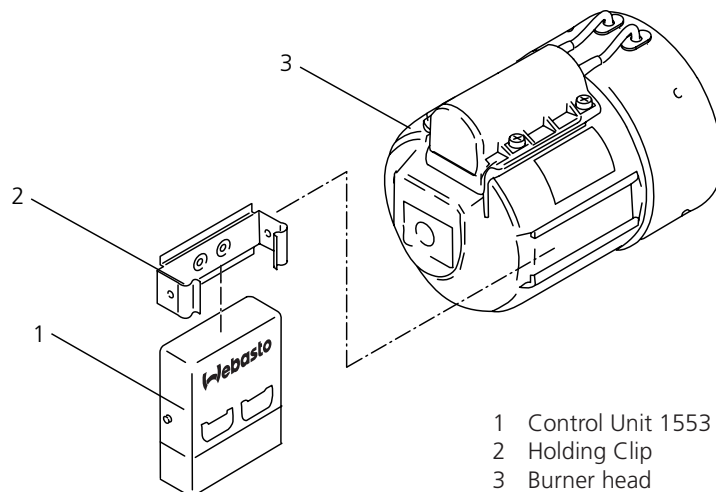
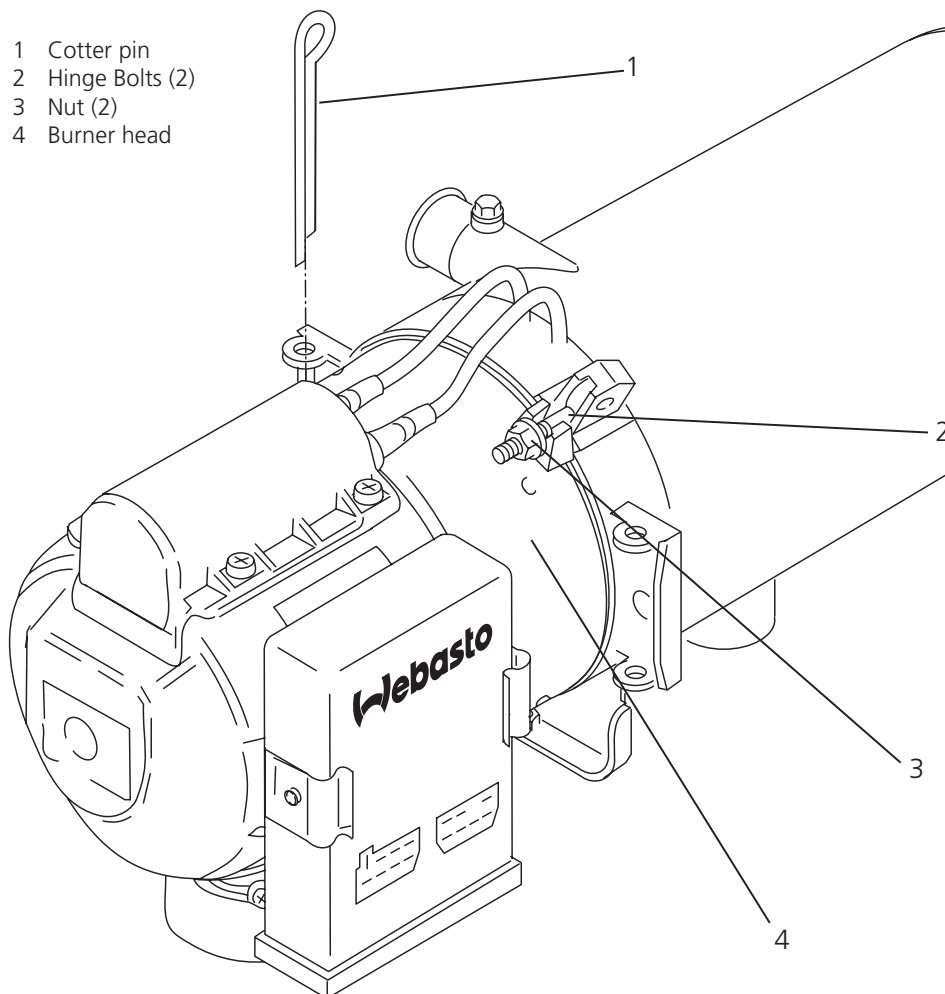


Figure 37: Control Unit Removal / Installation



NOTE: Depending on the burner head direction of swing, the cotter pin may be located to the opposite side.
CAUTION: Always use hinge bolts to lock burner head in place.

Figure 38: Burner Head Removal / Installation

9.2.6 FUEL VALVE AND SOLENOID, REPLACEMENT

9.2.6.1 REMOVAL

1. Swing open or remove burner head (see Sec. 9.2.5).
2. Disconnect the ignition leads from the ignition electrodes.
3. Loosen the retaining clamp bolt and dismount the ignition electrodes.
4. Remove disc retaining ring and disc. Allow the disc to hang from the electrical leads.
5. Disconnect the electrical leads from the fuel solenoid.
6. Unscrew the lock-nut (item 1, Fig. 39) securing the solenoid to the valve chamber (4) and slide magnetic head (3) back.
7. Unscrew valve chamber (4) from nozzle holder (9).

9.2.6.2 INSTALLATION

1. Unscrew lock-nut (item 1, Fig. 39) from new valve assembly.
2. Make sure new O-ring seal (5) is in place on valve chamber (4) and items 6, 7 and 8 are present and correctly oriented inside the valve chamber.
3. Screw assembled valve into nozzle holder and torque to 11.5 Nm (8.5 lb-ft).
4. Slide the magnetic head (3) into place making sure the boss registers in the end plate recess.
5. Secure with the lock-nut (1) and washer (2).
6. Install the round disc and retaining ring.
7. Connect electrical leads to fuel solenoid.
8. Install and adjust ignition electrodes (see Sec. 6.2.3).
9. Install burner head (see Sec. 9.2.5).

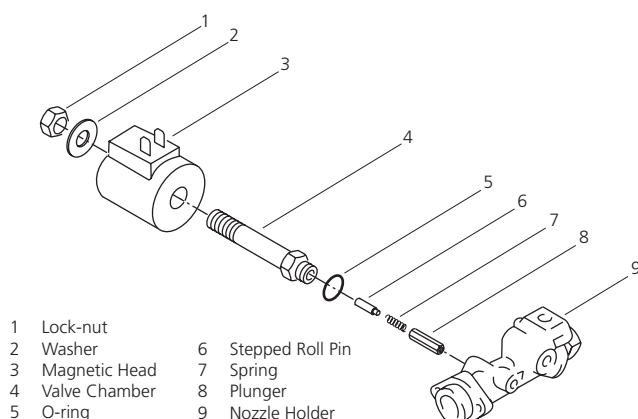


Figure 39: Fuel Valve and Solenoid Assembly

9.2.7 FUEL PUMP, REPLACEMENT

9.2.7.1 REMOVAL

1. Remove burner head (see Sec. 9.2.5).
2. Disconnect electrical leads from solenoid valve, flame detector, nozzle pre-heater and ignition electrodes.
3. Loosen the retaining clamp bolt and dismount the ignition electrodes.
4. Remove disc retaining ring and disc.



NOTE: During the following steps, ensure that escaping fuel is captured or immediately neutralized and properly disposed of.

5. Disconnect the fuel return and supply pipes from the fuel pump.
6. Disconnect the fuel delivery pipe from the pump to the nozzle holder.
7. Unscrew the four screws on the back wall and take the complete assembly out.
8. Remove the retaining ring from the fuel pump shaft and dismount the gear-wheel.
9. Remove the two bolts securing the fuel pump to the back wall.

9.2.7.2 INSTALLATION



NOTE: Do not disturb the pump pressure regulating screw. The pump has been pre-set to the correct pressure.

1. Attach new fuel pump to back wall with the two screws removed earlier.
2. Install gear-wheel on pump shaft and secure with retaining ring.
3. Dot gear-wheel in four places with ISOFLEX LDS 18 Special A lubricant P/N 143820 (45 gram tube).
4. Insert assembly into burner head being careful to mesh gears and secure with the four bolts removed earlier.
5. Connect fuel pipes.
6. Install disc with flame detector and retain with ring.
7. Install and adjust ignition electrodes (see Sec. 6.2.3).
8. Install burner head (see Sec. 9.2.5).

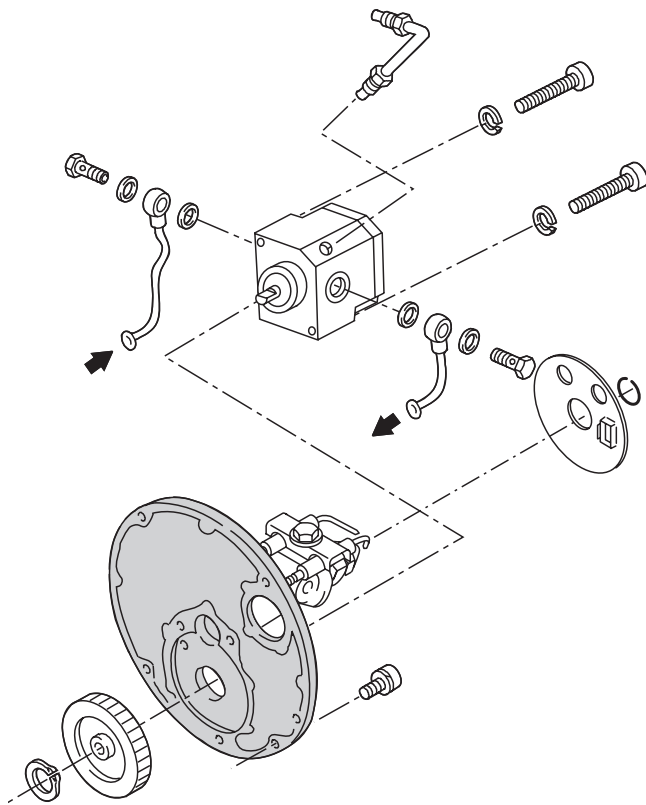


Figure 40: Fuel Pump Replacement

9.2.8 FUEL NOZZLE, REPLACEMENT

9.2.8.1 REMOVAL

1. Swing burner head open (see Sec. 8.5.1).
2. Unscrew and remove nozzle using a nozzle wrench or two wrenches (16 mm & 19 mm).



NOTE: Ensure cleanliness is maintained when installing the nozzle. Only touch the nozzle at its hexagon surface. The fuel nozzle should be replaced annually.



NOTE: If ignition electrodes are disturbed during nozzle replacement, they will require adjustment (see Sec. 6.2.3).

9.2.8.2 INSTALLATION

1. Screw in new high pressure nozzle and tighten to 20 Nm (15 lb-ft.).
2. Swing burner head closed (see Sec. 8.5.1).

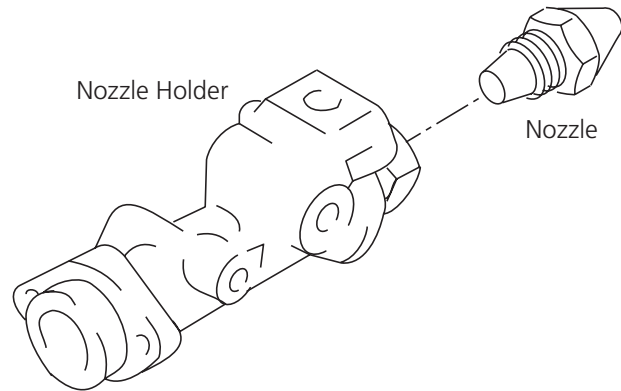


Figure 41: Nozzle Replacement

9.2.9 FLAME DETECTOR, REPLACEMENT

9.2.9.1 REMOVAL

1. Swing burner head open (see Sec. 8.5.1).
2. Remove screw and lock washer and slide flame detector out of slot in disc.
3. Disconnect electrical leads to flame detector.

9.2.9.2 INSTALLATION

1. Connect electrical leads to new flame detector.
2. Position flame detector in slot of disc and secure with screw and lock washer.
3. Tighten screw to 5 Nm - 6 Nm (44 - 53 lb-in.).
4. Swing burner head closed (see Sec. 8.5.1).

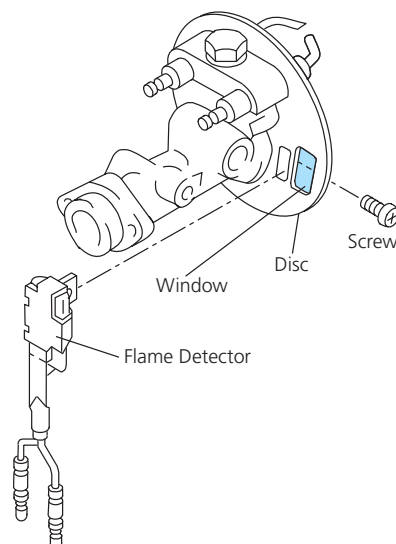


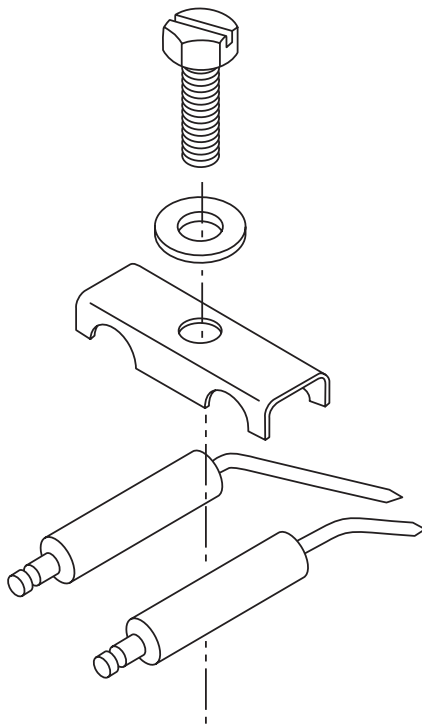
Figure 42: Flame Detector Replacement

9.2.10 IGNITION ELECTRODES, REPLACEMENT**9.2.10.1 REMOVAL**

1. Swing burner head open (see Sec. 8.5.1).
2. Disconnect the ignition leads from the ignition electrodes.
3. Loosen the retaining clamp bolt and dismount the ignition electrodes.

9.2.10.2 INSTALLATION

1. Install the new ignition electrodes.
2. Connect the ignition leads to the electrodes.
3. Adjust ignition electrodes (see Sec. 6.2.3).
4. Swing burner head closed (see Sec. 8.5.1).

**Figure 43: Ignition Electrode Replacement****9.2.11 IGNITION COIL, REPLACEMENT**

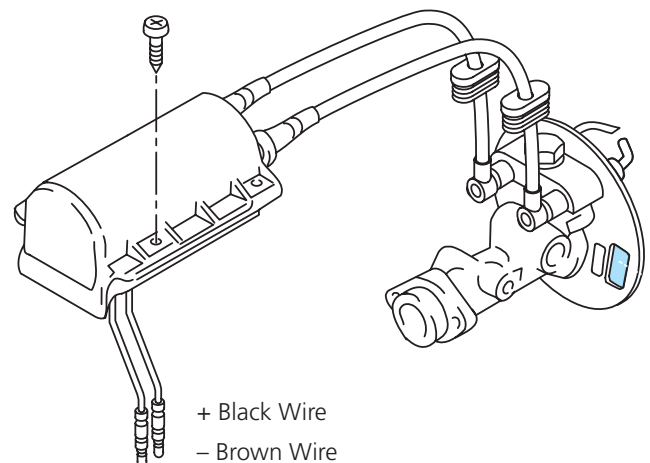
NOTE: If the ignition is faulty, check also the flame detector (see Sec. 6.2.2).

9.2.11.1 REMOVAL

1. Swing open or remove burner head (see Sec. 9.2.5).
2. Disconnect the ignition leads from the ignition electrodes.
3. Remove the four screws securing the ignition coil to the protection cap (see Fig. 44).
4. Lift coil off cap enough to access electrical connectors and disconnect.

9.2.11.2 INSTALLATION

1. Press electrical connectors together.
Brown – Brown
Black – Yellow
2. Place ignition coil into position making sure not to jam or trap electrical cables.
3. Secure ignition coil with four screws removed earlier.
4. Plug ignition leads onto ignition electrodes making sure to fully engage into their niches
5. Check electrode gap with gauge and adjust if necessary (see Sec. 6.2.3).
6. Swing burner head closed (see Sec. 9.2.5).

**Figure 44: Ignition Coil Replacement**

9.2.12 DRIVE MOTOR, REPLACEMENT

9.2.12.1 REMOVAL



NOTE: Take note of alignment of all components before disassembly.

1. Move ignition coil out of the way. See Sec. 9.2.11 for guidance.
2. Remove four screws (item 6, Fig. 45) and withdraw protection cap (1) from burner.
3. Disconnect motor leads.
4. Remove three screws (7) with lock washers and withdraw drive motor (2).
5. Remove two screws (8) from motor (2) and flange (3).
6. Inspect all parts for wear and damage and replace as necessary.

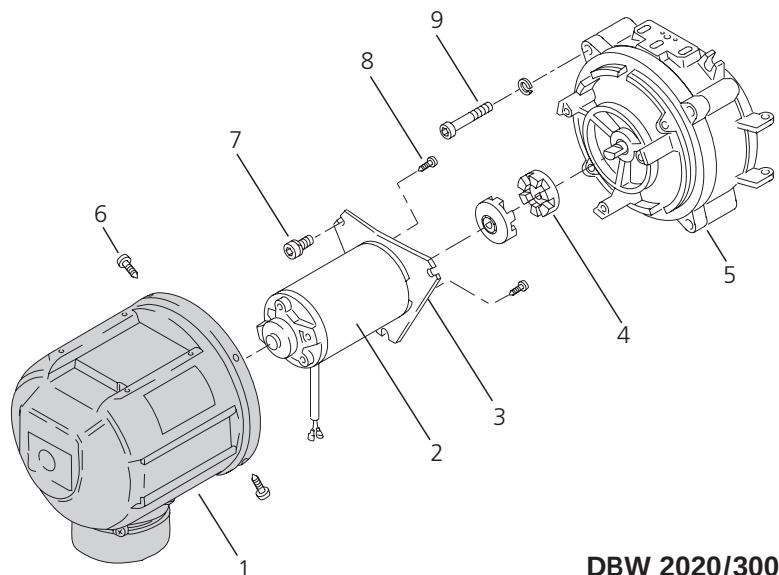
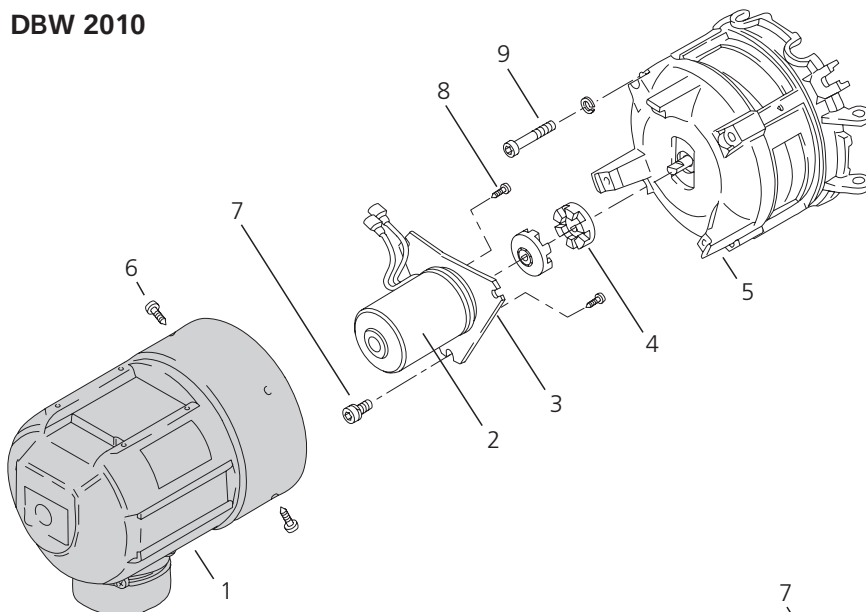
9.2.12.2 INSTALLATION



NOTE: Recessed edge of mounting flange (item 3, Fig. 45) must be oriented towards top. All items must be aligned as before disassembly.

1. Attach mounting flange (3) to drive motor (2).
2. Tighten screws (8) to 5 - 6 Nm (44 - 53 lb-in.).
3. Align motor shaft, coupler (4) and flange (3) with housing (5) and attach with screws (7).
4. Tighten screws (7) to 5 - 6 Nm (44 - 53 lb-in.).
5. Connect motor electrical leads.
6. Locate protection cap (1) and secure with the four screws (6) removed earlier.
7. Tighten screws (6) to 2 Nm (18 lb-in.).
8. Install ignition coil

DBW 2010



DBW 2020/300

Figure 45: Drive Motor Assembly

9.2.13 COMBUSTION AIR FAN, REPLACEMENT



NOTE: For replacement of the combustion air fan the burner may be left installed. In removed condition ensure that igniter electrodes are not bent and nozzle is not damaged.

9.2.13.1 REMOVAL

1. Swing open or remove burner head (see Sec. 9.2.5)
2. Move ignition coil out of the way. Refer to Sec. 9.2.11 for guidance.
3. Remove four screws (item 6, Fig. 45) and withdraw protection cap (1) from burner.
4. Disconnect motor leads.
5. Remove drive motor (see Sec. 9.2.12).
6. Remove four Allen Socket screws (item 1, Fig. 46) and washers (2) from motor carrier (3).
7. Remove four screws (10) from nozzle holder plate (9) and pull plate free.

DBW 2010 ONLY:

8. Remove lock-nut (8), drive gear (7) and washer (6).
9. With a hammer and small drift, tap fan shaft and fan (4) free from housing (5)
10. Perform further disassembly of shaft, bearings and gears if necessary (see Sec. 9.2.15).

DBW 2020/300 ONLY

11. Grasp motor carrier (item 3, Fig. 46) and with a slight rocking motion, work the motor carrier and fan (with bearing), free from housing (5).
12. Perform further disassembly of shaft, bearings and gears if necessary (see Sec. 9.2.16).

9.2.13.2 INSTALLATION

DBW 2010 ONLY:

1. Assemble bearings and components if required (see Sec. 9.2.15).
2. Push fan with shaft through bearings and spacer of housing (item 5, Fig. 46)
3. Install washer (6), drive gear (7) and lock-nut (8).
4. Adjust fan clearance according to instructions in Sec. 9.1.1.4.

DBW 2020/300 ONLY

5. Assemble fan, shaft, bearings and drive gear components if required (see Sec. 9.2.16).
6. Make sure O-ring (item 10, Fig. 48) in bearing recess of housing (item 5, Fig. 46) is present and in place.
7. Push fan assembly into housing (5) until motor carrier (3) is fully seated.

DBW 2010/2020/300

8. Install motor carrier (item 3, Fig. 46) over fan (4).
9. Install and tighten screws to
 - DBW 2010 - 5.5 - 6.5 Nm (48.5 - 57.5 lb-in).
 - DBW 2020/300 - 8.0 Nm $\pm$ 10% (71 lb-in $\pm$ 10%).
10. Install drive motor (see Sec. 9.2.12).
11. Connect electrical leads.
12. Install protection cap and secure with four screws (item 6, Fig. 45) removed earlier.
13. Install ignition coil. Refer to Sec. 9.2.11 for guidance.

9.2.14 FAN REPLACEMENT

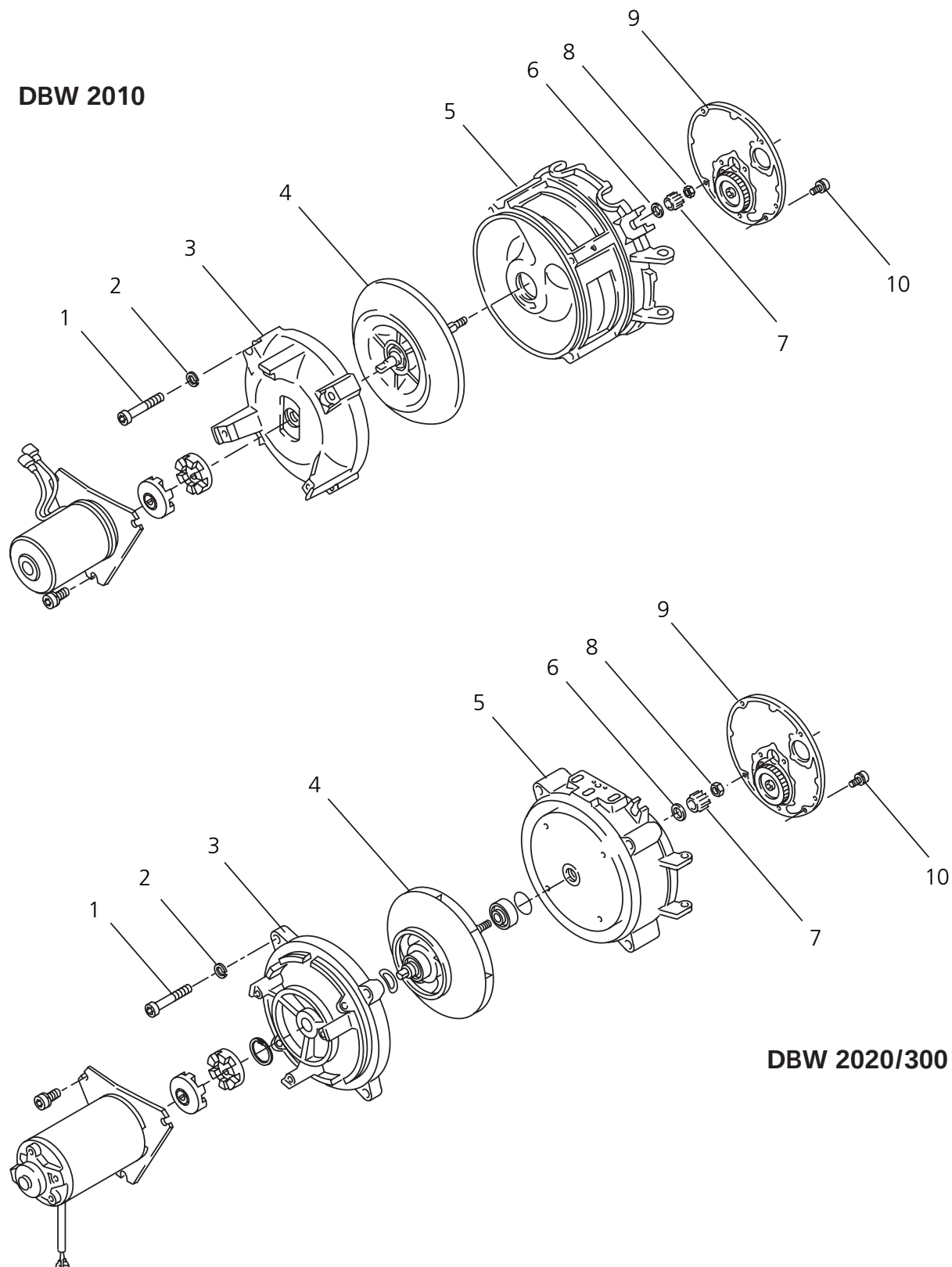


Figure 46: Fan Replacement

9.2.15 FAN SHAFT, BEARINGS AND GEARING, EXPLODED VIEW (DBW 2010)

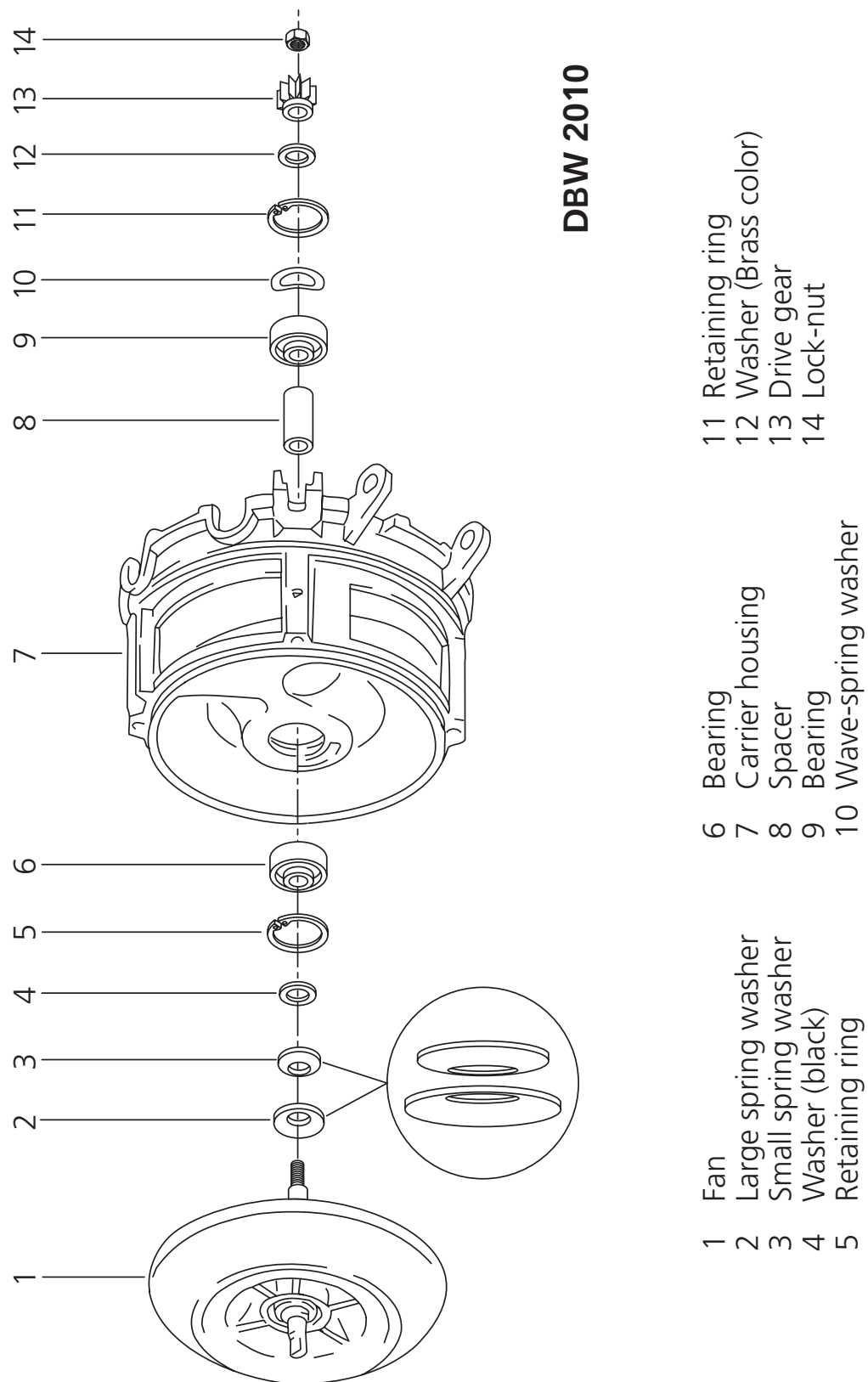


Figure 47: Exploded view - fan support assembly - DBW 2010

9.2.16 FAN SHAFT, BEARINGS AND GEARING, EXPLODED VIEW (DBW 2020 / DBW 300)

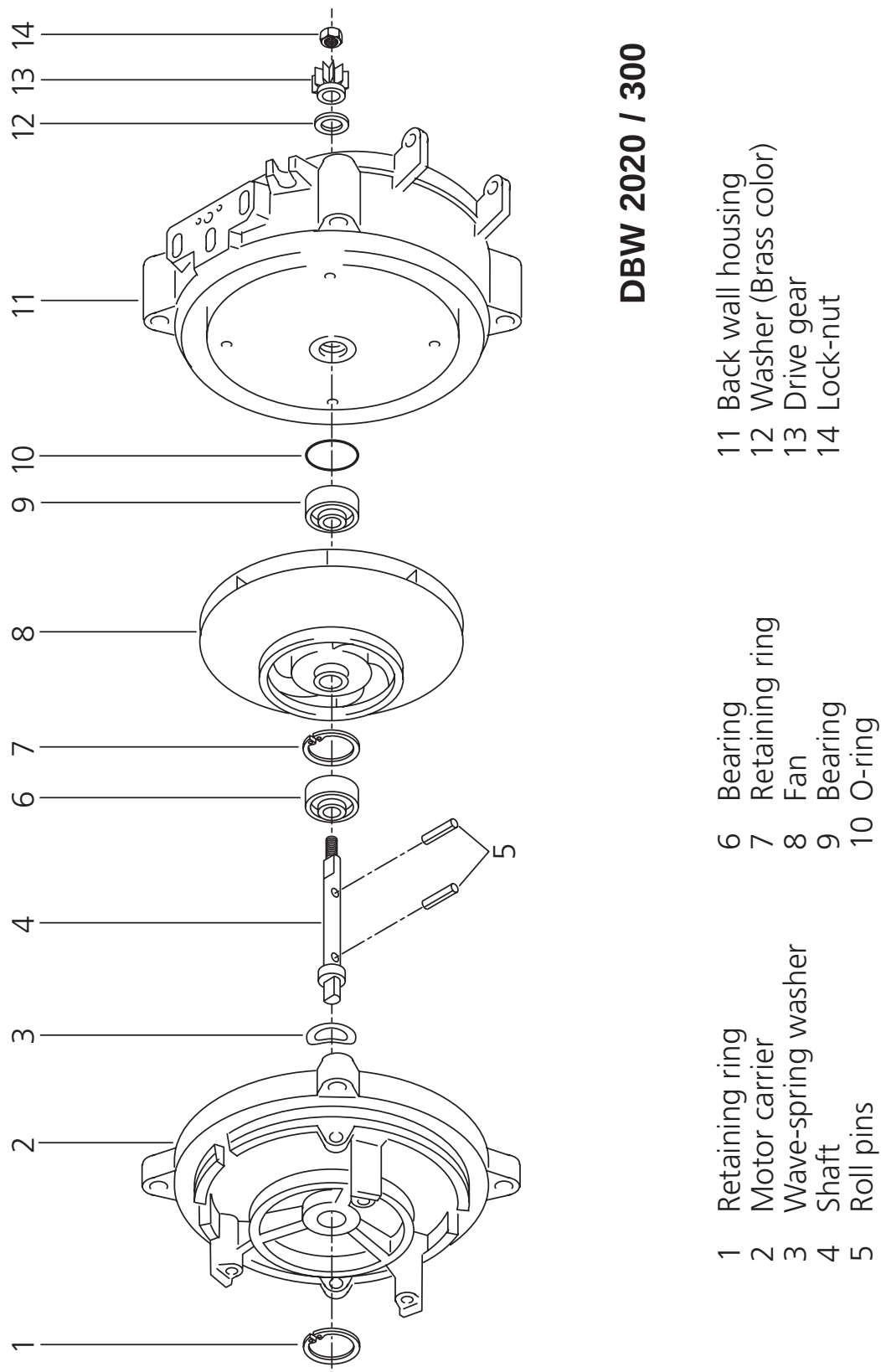


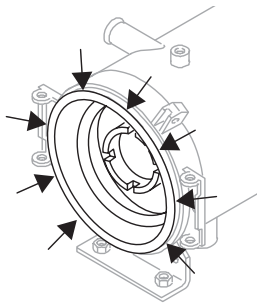
Figure 48: Exploded view - fan support assembly - DBW 2020/300

9.2.17 COMBUSTION CHAMBER, REPLACEMENT**9.2.17.1 REMOVAL**

1. Swing burner head open (see Sec. 8.5.1).
2. Withdraw combustion chamber (Fig. 50) from heat exchanger and remove.



NOTE: The DBW 2010 burner tube may require careful prying around the parameter of the tube to release it from the heat exchanger (see Fig. 49).



DBW 2010 burner tube removal. Carefully pry out with screw driver.

Figure 49: DBW 2010 Burner tube removal

3. Perform procedures on components after disassembly (see Sec. 9.1.1).



NOTE: DBW 2010 Only: In case the combustion air swirler has been damaged, distorted or melted by high heat of a burn-back condition, the complete combustion chamber and the flame detector must be replaced.

9.2.17.2 INSTALLATION

1. Slide combustion chamber fully into the heat exchanger.
2. Swing burner head closed (see Sec. 8.5.1).

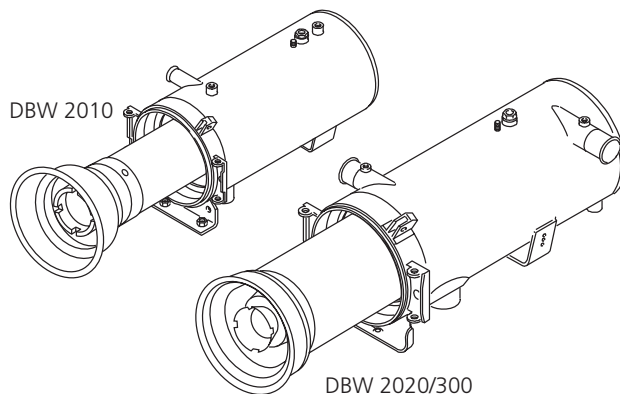


Figure 50: Burner tube replacement

9.2.18 HEAT EXCHANGER, REPLACEMENT**9.2.18.1 REMOVAL**

1. Disconnect cables from temperature control thermostat, temperature limiter and overheat fuse.
2. Detach cables from heat exchanger.
3. Remove burner head (see Sec. 9.2.5).
4. Withdraw combustion chamber from heat exchanger.
5. Remove heat exchanger.
6. Perform procedures on components after disassembly (see Sec. 9.1.1).



NOTE: It is important that the heat exchanger and combustion chamber are cleaned and inspected periodically and at least annually.

9.2.18.2 INSTALLATION

1. Slide combustion chamber fully into heat exchanger.
2. Install burner head (see Sec. 9.2.5).
3. Attach cables to heat exchanger
4. Install and connect temperature control thermostat, temperature limiter and overheat fuse.

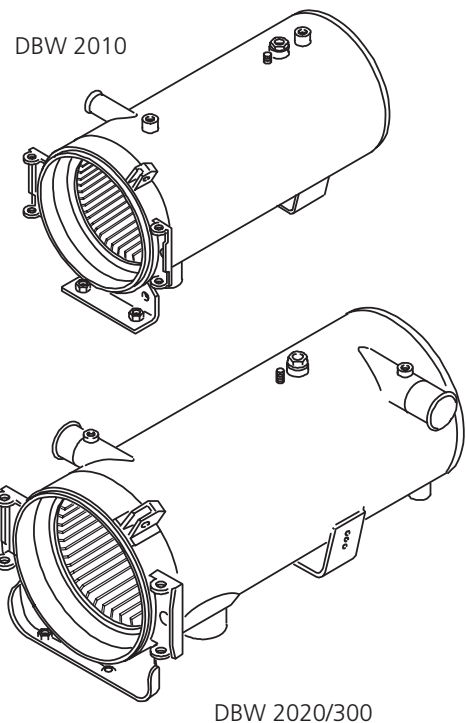


Figure 51: Heat exchanger replacement

9.3 COOLANT CIRCULATING PUMP REPAIR

A defective coolant pump may cause the heater to overheat. The heater's overheat protection is likely to respond in this case.

9.3.1 REMOVAL

1. Drain the coolant. Alternatively, the hoses leading to the pump can be pinched closed with hose clamping pliers.
2. Disconnect the circulation pump electrical leads.
3. Disconnect coolant hoses from pump.
4. Dismount coolant pump.

9.3.2 DISASSEMBLING

1. Clean the exterior of the pump and hold pump in a soft-jaw vice.
2. Unscrew the impeller housing screws and remove housing and O-ring.
3. Unscrew the impeller nut and carefully pry off impeller with two screwdrivers.
4. Remove the spring seal, ceramic and rubber seals.
5. On the U4810 pump, unscrew the pump base screws and remove the base and the O-ring.
6. Inspect all parts and replace if necessary. Seals are always replaced.

9.3.3 ASSEMBLING

1. Connect pump motor to a power source. With a strip of very fine emery cloth, polish the pump shaft to remove any contamination.
2. Remove power source from pump motor.
3. Assemble pump with all parts in order as shown in Fig. 53 through Fig. 55. The ceramic seal and the spring seal must be fitted as shown in Fig. 52 with the hard side of the spring seal (B) against the ceramic seal face (A).

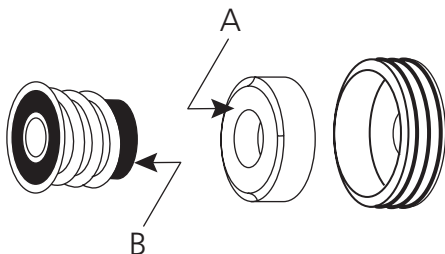
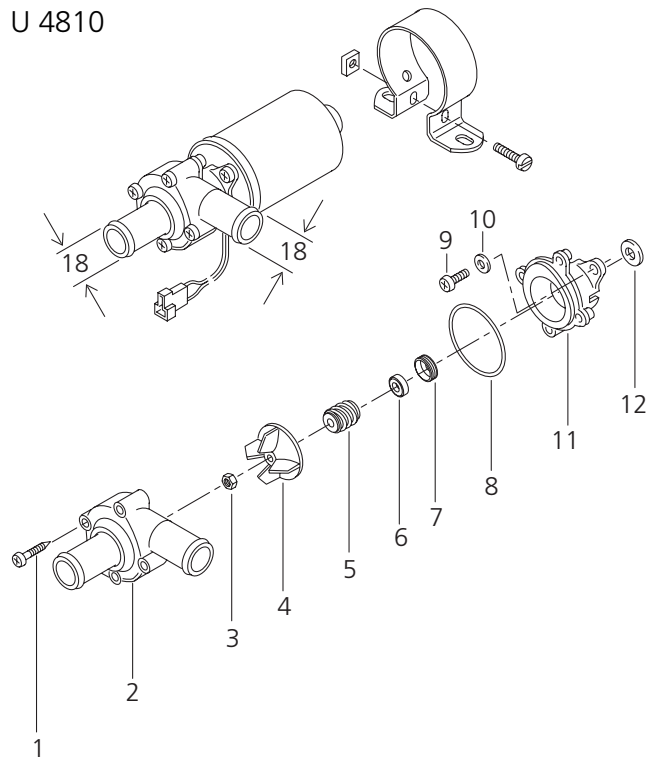


Figure 52: Seal Orientation

9.3.4 INSTALLING

1. Mount the pump.
2. Connect coolant hoses to pump and tighten hose clamps.
3. Remove hose clamping pliers if used.
4. Connect the electrical leads and seal connector with dielectric grease such as Permatex® Dielectric Tune-up Grease or 3M™ Silicone Paste (Dielectric Grease).
5. Refill coolant system and bleed trapped air out of the coolant circuit according to instructions in Sec.8.8.1.
6. Switch on and check function and for any leakage.

U 4810



- | | |
|----------------------------|-----------------------|
| 1 Screw - Impeller Housing | 7 Rubber Seal |
| 2 Impeller Housing | 8 O-ring |
| 3 Nut - Impeller | 9 Screw - Pump Base |
| 4 Impeller | 10 Washer - Pump Base |
| 5 Spring Seal | 11 Pump Base |
| 6 Stationary Ceramic Seal | 12 Rubber Shaft Seal |

Figure 53: U4810 Circulation Pump - Exploded View

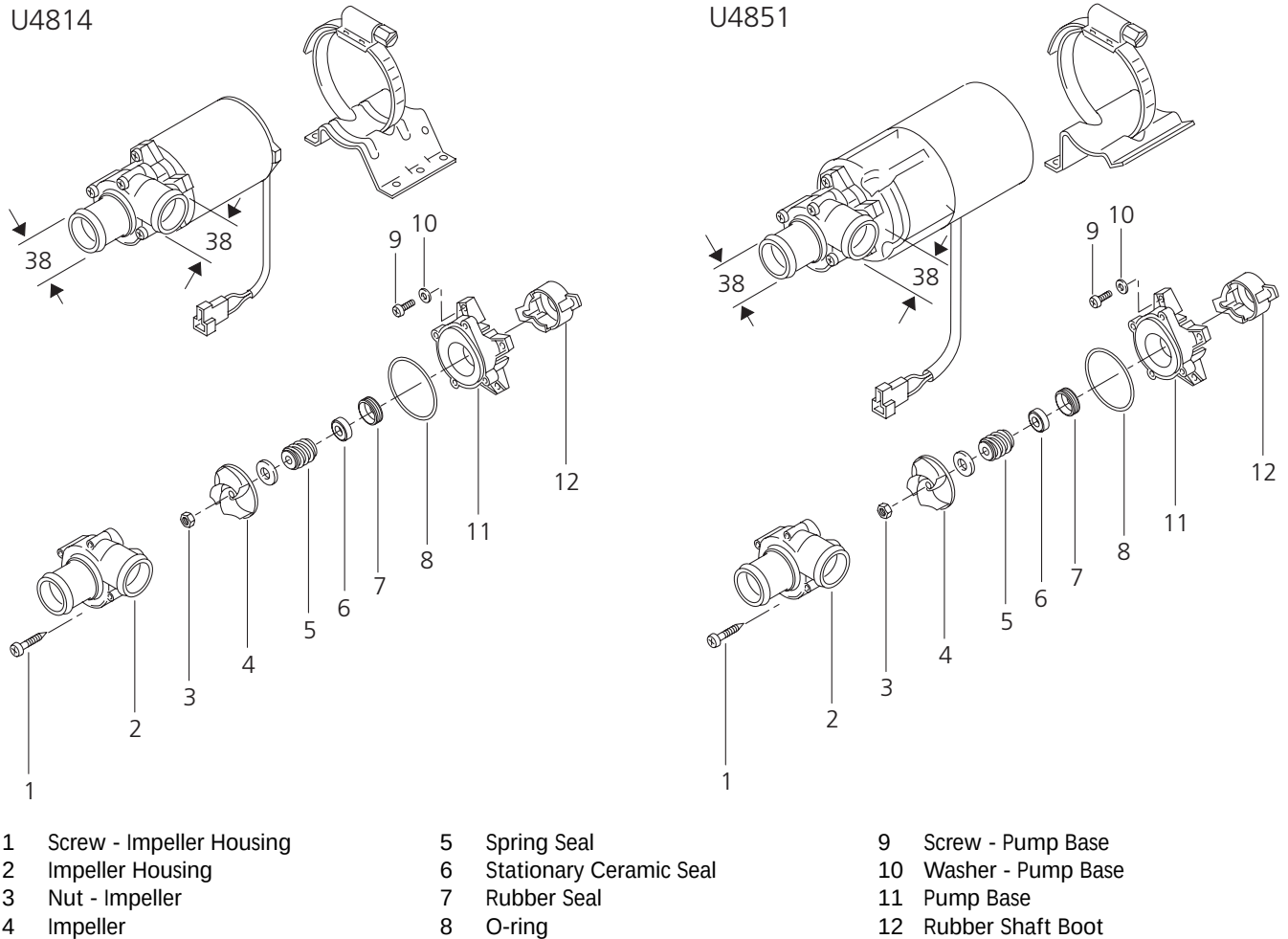


Figure 54: U4814 and U4851 Circulation Pump - Exploded View

U 4846 Pump Only: Pump is magnetically coupled to the motor (no shaft seals to leak or replace). The driven magnet of the pump must be free of metallic contaminants otherwise the heater may overheat due to loss of coolant circulation. The heater's overheat protection is likely to respond.

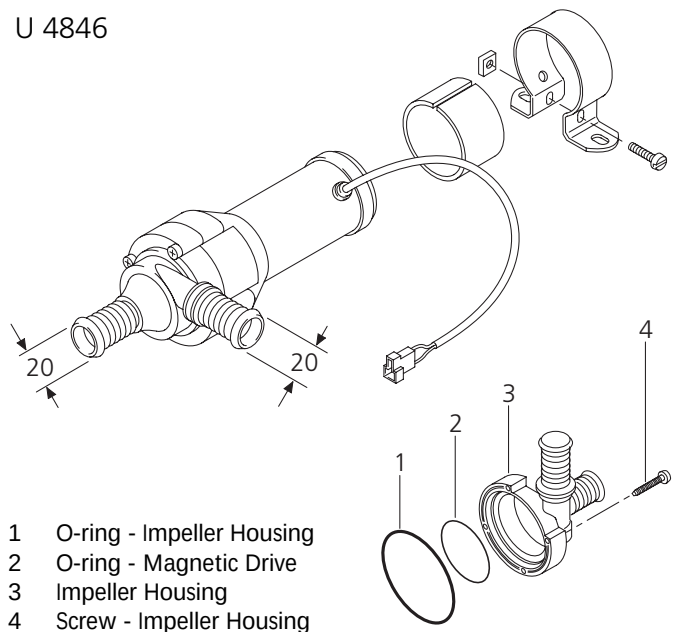


Figure 55: U4846 Circulation Pump - Exploded View

9.4 MP SCHOOL BUS CIRCULATION PUMP

9.4.1 REMOVAL

1. Drain the coolant. Alternatively, the hoses leading to the pump can be pinched closed with hose clamping pliers.
2. Disconnect the circulation pump electrical leads.
3. Disconnect coolant hoses from pump.
4. Dismount coolant pump.

9.4.2 DISASSEMBLING

1. Clean the exterior of the pump and hold pump in a soft-jaw vice.
2. Unscrew the impeller housing screws and remove housing and O-ring.
3. Unscrew the impeller lock screw and remove impeller.
4. Remove the seal assembly.
5. Remove the pump adapter (base).
6. Inspect all parts and replace if necessary. Seals are always replaced.

9.4.3 ASSEMBLING

1. Connect pump motor to a power source. With a strip of very fine emery cloth, polish the pump shaft to remove any contamination.
2. Remove power source from pump motor.
3. Assemble pump with all parts in order as shown in Fig. 53.

9.4.4 INSTALLING

1. Mount the pump.
2. Connect coolant hoses to pump and tighten hose clamps.
3. Remove hose clamping pliers if used.
4. Connect the electrical leads and seal connector with dielectric grease such as Permatex® Dielectric Tune-up Grease or 3M™ Silicone Paste (Dielectric Grease).
5. Refill coolant system and bleed trapped air out of the coolant circuit according to instructions in Sec.8.8.1.
6. Switch on and check function and for any leakage.

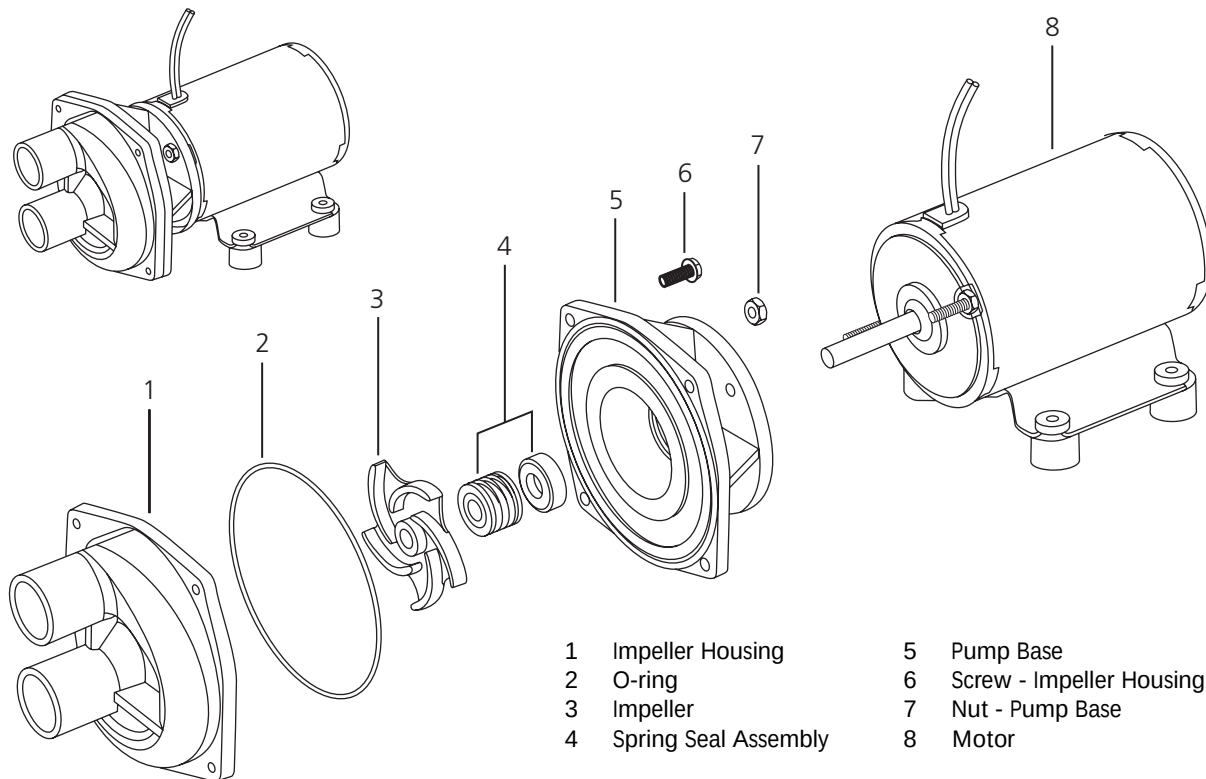


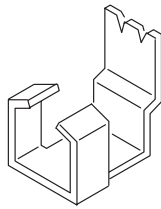
Figure 56: MP School Bus Circ. Pump - Exploded View

10. INSTRUMENTS AND TOOLS

10.1 SETTING GAUGE

Used for setting the gap between the points of the electrodes and the distance from the fuel nozzle.

Part Number 310646



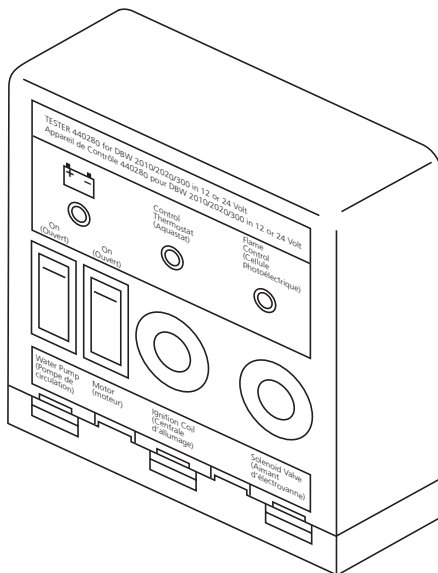
10.2 TESTER

Used for testing components of the heater, test running the heater, making fuel pressure adjustments when used with a pressure gauge and general troubleshooting.

Tester is connected in place of the control unit.

Tester Part Number 1302691A

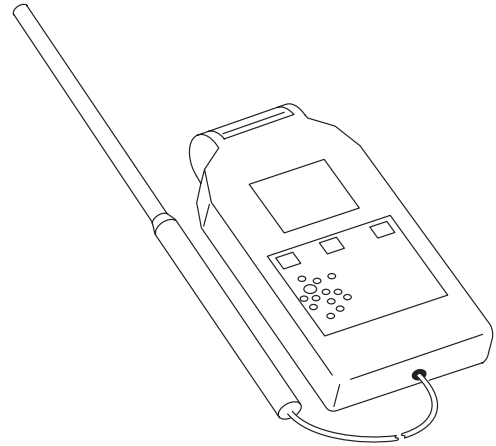
An optional 5 ft. extension harness (P/N 905491A) is available for tester where additional reach is required.



10.3 CO₂ TEST APPARATUS

Used for sampling and measuring the CO₂ content of the exhaust gases.

In the case of irregularities of the combustion process or after major repairs, the CO₂ content should be measured and adjusted as necessary.



10.4 SMOKE NUMBER TEST APPARATUS

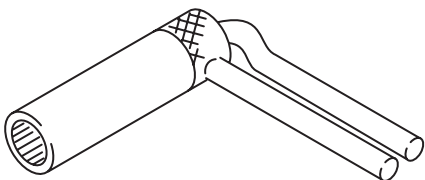
Used for checking smoke number



10.5 NOZZLE WRENCH

Used for replacing high-pressure fuel nozzle.

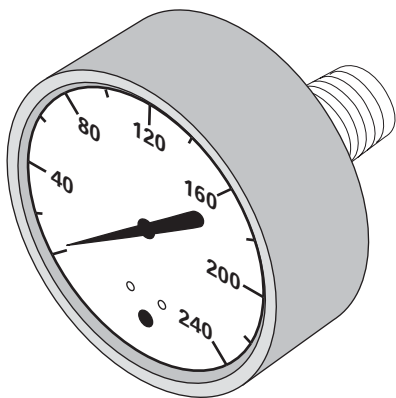
Part Number 66971A



10.6 FUEL PRESSURE GAUGE

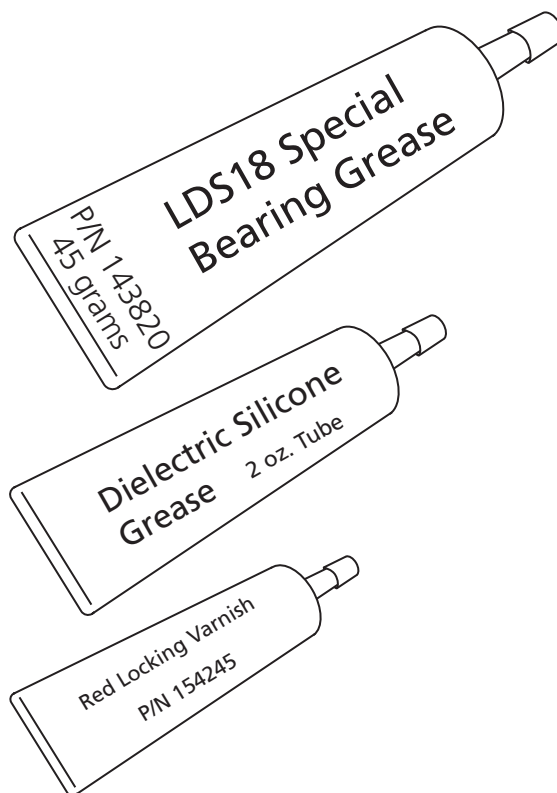
Used for checking and adjusting the fuel pressure delivered to the nozzle.

Part Number 600190



10.7 GREASE AND LOCKING VARNISH

- LDS 18 Special - used for lubricating the reduction gearing of the fuel pump drive.
- Dielectric Silicone Grease - used to protect electrical terminals and connectors from corrosion.
- Red Locking Varnish - used to indicate setting positions such as on the air intake locking screw once adjusted.



11. PRODUCT INFORMATION

11.1 ISS "WHITE" TIMER FOR THE SCHOLASTIC HEATER™

Category: Thermosystems

Document Number: PI007RC

Date Posted: 02/02/2007

Description: ISS "WHITE" TIMER INSTALLATION / OPERATION INSTRUCTIONS



Overview

The ISS "White" timer is a 7-day NOI (no operator interface) timer. This means you can set this timer to specific needs and the timer will do the rest. This timer has battery backup and will hold its memory if the vehicle battery is disconnected and will recharge when 12 volt power is restored.

Installation

The timer should be installed in an area protected from the effects of weather and contamination. The timer can be surface mounted on the vehicle instrument panel or inside the circuit panel (Bus applications) or any place convenient and accessible.

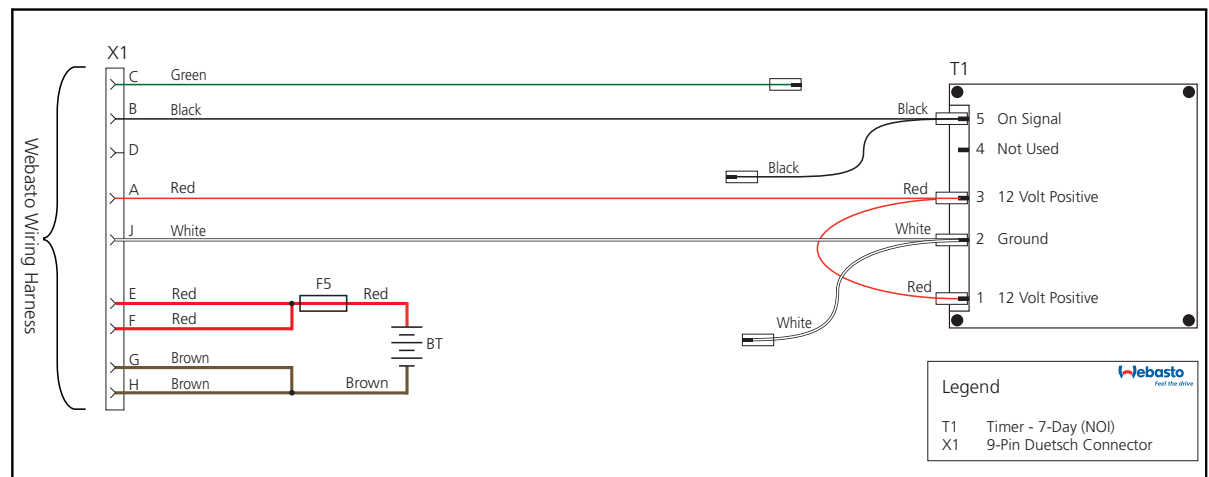
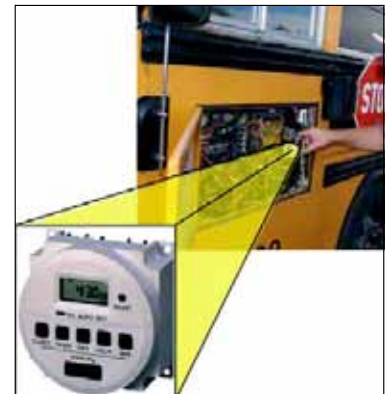
The timer can be mounted using customer/installer supplied Velcro tape by sticking one half of the Velcro to the timer and the other to a secure mounting location. The timer can be mounted with screws in place of Velcro.

Connect the Webasto heater switching harness to the timer. Refer to the wiring diagram below for directions.

After all connections are made, mount the new timer. Using customer/installer supplied Velcro tape or screws.

Optionally, an On/Off toggle switch can be installed with the timer. The timer will work without using the toggle switch however, it's a nice option to have.

To mount the toggle switch, locate an appropriate mounting location and drill a ½" mounting hole. Refer to the wiring diagram on next page to, connect the appropriate wires to the toggle switch.



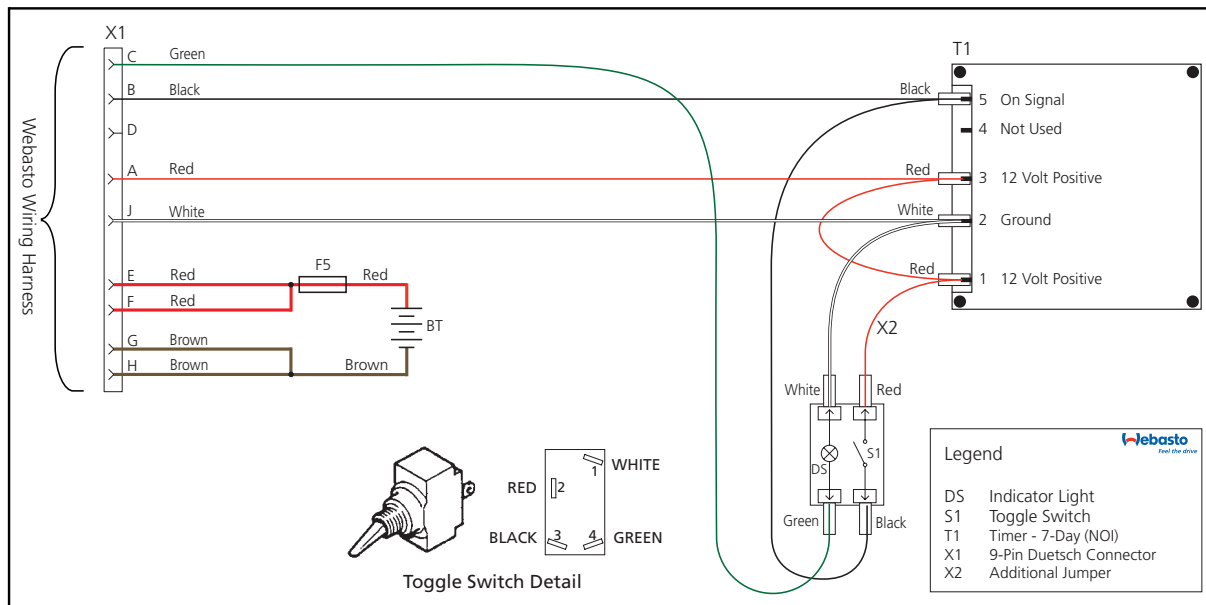
Wiring diagram - ISS Timer

Category: Thermosystems

Document Number: PI007RC

Date Posted: 02/02/2007

Description: ISS "WHITE" TIMER INSTALLATION / OPERATION INSTRUCTIONS



Wiring diagram - ISS Timer with optional Toggle Switch

Setting the Timer

The ISS timer is a 7-day NOI (no operator interface) timer. This means you can set this timer to specific needs and the timer will do the rest. This timer has battery backup and will hold its memory if the vehicle battery is disconnected and will recharge when 12 volt power is restored.

To set the timer clock:

Press and hold the "Clock" button and by pressing the "Hour" and "Min." buttons set the clock appropriately. In the upper left corner you will see the "AM" or "PM" sign.

Setting the timer On/Off functions:

Press the "Timer" button one time. You will see the screen now reads "1" "On" using the day button select the appropriate day or days. Look in the upper left hand corner for the "AM" or "PM" sign. Using the day button you can select one or multiple days. After you have selected the proper day/days and set the appropriate on time, push the "Timer" button once again. You should now see "1" "Off" using the day button select the appropriate days again.

BE SURE THE DAYS SELECTED MATCH THE SAME DAYS YOU SELECTED FOR TIMER "1" "ON".

Now set the timer to the appropriate "Off" time. After you have set the timer functions needed, push the "Clock" this will save your settings and return to the clock.

These steps can be repeated 6 more times giving you multiple on and off settings. It is very important that you set this timer to the specific needs of each vehicle to optimize the heaters efficiency.

Category: Thermosystems

Document Number: PI007RC

Date Posted: 02/02/2007

Description: ISS "WHITE" TIMER INSTALLATION / OPERATION INSTRUCTIONS

**Operation in manual mode:**

The largest button on the timer is the "Manual" button. At the bottom of the "LCD" screen you will see a small line that moves as you push this button. Underneath the small line you will see the corresponding function "On" "Auto" "Off". The manual button can be used as a toggle switch to operate the heater or after you have programmed the timer for automatic service, push the manual button until the line is over "auto" on the timer. The timer will now turn the heater on and off at the times preset earlier.

NOTE:

The toggle switch will illuminate green when the heater has an "On" signal. If the toggle switch is in the "Off" position and the timer has turned the heater on, the toggle will illuminate green. This is an easy way to identify the heater is in operation. While the timer is "On" the toggle switch will NOT operate the heater. The toggle switch is a master switch whenever the timer is not in operation.

Safety Precautions:

- The heater must be switched off at filling stations and tank farms as a result of the risk of explosion.
- The heater may not be operated in enclosed spaces (such as garages) as a result of the risk of poisoning and asphyxiation, even if a timer is used.
- Wherever inflammable vapors or dust may form (for example in the vicinity of fuel, carbon, wood dust or cereal stores or the like), the heater must be switched off as a result of the risk of explosion.



As with other devices whose activation is automated, if a particular application presents a risk should the heater be automatically activated, and such a vehicle or application is equipped with a "power cut off" type switch which prevents devices from activating automatically, then this timer/heater should be wired into this "power cut off circuit" to ensure automated activation of the heater does not occur.

WARRANTY COVERAGE AND LIMITATIONS

Webasto Product North America, Inc. (herein after referred to Webasto) warrants their heaters and heater kits against defects in material and workmanship for two (2) years effective at the time of installation or vehicle registration date for Original Equipment installations (OE). This warranty period may not exceed three (3) years from the original date of sale by Webasto. This warranty period may be superseded by a contractual agreement.*

**Warranty coverage for Marine and Off-road applications containing DBW series heaters and the CSL Cargo Heaters are limited to a maximum of 3,000 hours of usage. All other models are limited to 2,000 maximum hours.*

Replacement parts are covered for six (6) months or the remainder of the original warranty period, whichever ever is longer. Replacement heaters are considered a "Replacement Part."

The intent of the Webasto warranty is to protect the end-user heater from such defects and provide free repair and replacement of defective parts in the manner provided herein. During the warranty period the exclusive remedy will be for Webasto, at their discretion, to repair or replace those parts which are demonstrated to be defective in material or workmanship.

While warranty is provided to the "end-user", it is to be administered and serviced through an authorized Webasto dealer in accordance with the Webasto warranty policy or contractual agreement between Webasto and a second party.

Limitations: Webasto specifically excludes and limits from warranty the following:

- Normal wear of service parts: **(fuel nozzles, filters and overheat fuses are not covered).**
- Removal and replacement of heater (with the exception of the Thermo Top C).
- Damage to product in transit. All claims must be filed with carrier.
- Improper installation, which is not in accordance with valid, supplied installation instructions or approved OEM applications.
- Deterioration due to normal wear, corrosion, abuse, damage, accident, improper storage or operation.
- Modification of product by alteration, use of non-genuine parts or repair by unauthorized personnel.
- Economic loss for expenses related to travel, vehicle disability, personal injury or other incidental or consequential damages arising from any breach of this expressed warranty.

Owner's Responsibilities:

- 1) Service heater at the start of each season by an authorized Webasto dealer (Service parts including; fuel nozzles, filters and overheat fuses are not covered under warranty).
- 2) A Warranty Registration Card is included with the sale of each heater. It is the owner's responsibility to complete this card and return it to Webasto for registration. A proof of purchase is required for all heaters that are not registered.

This warranty gives you specific legal rights and you may also have other rights which vary by State or Province

THE WARRANTY DESCRIBED IN THIS POLICY SHALL BE IN LIEU OF ANY OTHER WARRANTY, EXPRESSED OR IMPLIED, INCLUDING BUT NOT LIMITED TO, ANY IMPLIED WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE.

YOUR NOTES



WEBASTO PRODUCT N.A., INC.

15083 North Road
Fenton, MI 48430

Technical Assistance Hotline
USA: (800) 860-7866
Canada: (800) 667-8900

www.techwebasto.com
www.webasto.us